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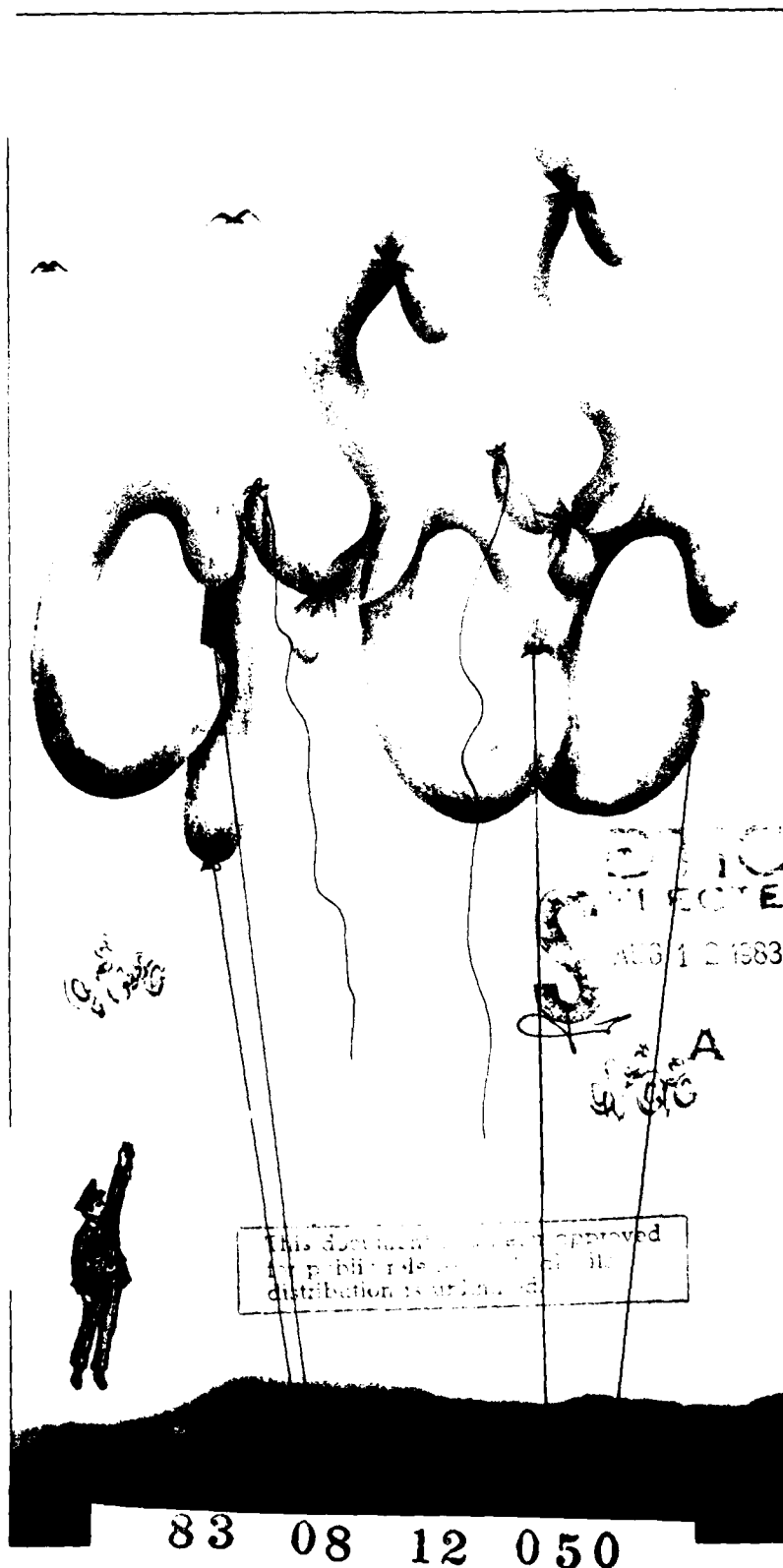# Taking the Heartburn Out of CS²

The Cost of CS²

1983 Update on Ada Computer Language

Special Supplement: Soviet Military Power

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CONTENTS

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Defense—
But Not at
ANY COST

Lieutenant General Hans H. Driessnack, USAF
Vice Chief of Staff

UNEMPLOYMENT OFFICE

A few budget cycles ago we became somewhat excited that the country had given our President a mandate to modernize and rebuild our military forces.

Today it appears that we are losing that strong support. A military spending has dropped from a post-electoral high of more than 75 percent to a mere 17 percent. This tells me that taxpayers have become uneasy—fed up—not with our push for readiness, or modernization, or rebuilding our defense forces, but they are concerned about our abilities to control acquisition cost growth.

I am convinced that Americans want a strong defense—but not at any price.

The news media constantly remind us of record high unemployment nationwide and business bankruptcies while, at the same time, the public reads about the rising cost of our weapon systems. There are reports of union concessions and give-backs in the automotive industry and layoffs in the steel mills alongside reports of percentage increases in wages and salaries in defense industry.

I'm not arguing with the validity of what's in the news, but I do offer that you need to understand and appreciate how these items can affect our support base. I'm convinced that we can't have a strong defense if we don't have a strong economy.

The prevailing economic conditions have placed additional pressure on the Congress. Many members of Congress view major reductions in defense spending as the key to the President's efforts to balance the budget. Our lawmakers have narrowed the number of alternatives to eliminate the deficit down to three basic approaches:

—Cut social programs
—Increse taxes
—Cut defense spending.

With defense being billed as a big spender of tax dollars, it receives a great deal of visibility in Congress and in the press. With this level of emphasis and interest increasing daily, there is no question that the defense budget will be challenged.

This article is based on General Driessnack's presentation to the Air Force Systems Command Contracting and Manufacturing Conference held at Andrews AFB, Md., in January of this year.

The most recent manifestation of this challenge is the fiscal 1983 Continuing Resolution Authority (CRA), with all of its restrictions and directions.

The time has passed when minor engineering changes are supported without significant congressional intervention. There can be no more C-5A ventures. The Nunn-McCurdy Amendment will require full justification for cost overruns that exceed 15 percent of unit cost or 25 percent of program target cost. Our challenge should be to take whatever cost reduction actions are necessary to avoid such occurrences.

Cost Control Consciousness

We must develop and maintain a sense of "cost control consciousness" so that it becomes ingrained in our thought process. Neither economic conditions nor Congress should have to force-feed needed cost reductions on us. We should do it because it simply makes good business sense.

The theme throughout DOD should be to institutionalize efficiency in defense spending, not only in high-dollar items purchased in Systems Command, such as F-16, F-15, B-1B, and C-5B, but for each tax dollar spent, regardless of the level of buying activity. When we intensified the cost growth control initiatives last year, our aim was directed at the small-dollar buying activities as well as the large buying divisions—from Aeronautical Systems Division to Pope AFB, from the billion-dollar contracts to the $100 purchase orders. We must be constantly mindful of the scarcity of the funds we have and to seek the most productive and efficient way to spend these funds.

Our efforts to control cost growth are not new revelations. We have always been concerned about excessive costs and cost overruns. "Should cost" is not a new technique, nor is value engineering nor Cost/Schedule Control System Criteria. We need to keep educating our people on the value of these management tools. If there is a new wrinkle, it is the tough position that our President, the Secretary of Defense, Secretary of the Air Force, and our Chief of Staff are taking by not just being concerned about it, but actually doing something about it. We have declared war on cost overruns.

We started in mid-1982 with a strong concentration on compensation costs. The Secretary of the Air Force took a tough position that was presented to industry and now has been introduced to every buying activity in the Air Force. We met with the chief executive officers of our major contractors, sent letters to field commanders, and conducted numerous interviews with the news media to get the word out. Later we expanded our thrust and established an *ad hoc* task force for contracting and pricing policies. In addition to compensation costs, we focused our attention on each element of total cost that contributes to cost growth.

Recently, the Air Force took a strong stance against the payment of profit on increases that result from the use of Economic Price Adjustment (EPA) clauses. Profit simply must not ride the back of inflation. I will go further and state that, in my opinion, we need not and should not rely on EPA provisions at all. We are giving only lip service to our President when we say that "we support you, Mr. President, in this fight against inflation," and then place EPA clauses in the contract just in case.

In my opinion, if we don't do something positive to control these consistent cost increases, the defense industry in this country will price itself out of the market, just as auto and steel did.

War on Cost Growth

The Air Force war on cost growth—or "project cost," as defined in Systems Command—can bring about the cost savings we seek and need. We have already achieved some cost reductions by challenging excessive labor rate increases through value-engineering initiatives, competitive contract awards, multiyear contracting, and should-cost analysis.

In fiscal 1982, the Air Force realized savings of $739 million, the highest ever recorded in the history of the program. Of that, $49.9 million was due to contractor savings.

A mini "should-cost" conducted by AFLC on the B-52 Offensive Avionics System (OAS) modification resulted in a cost reduction of $600 million.

At Mather AFB, the base contracting officer, Major Rodney Showers, with the support of the regional labor relations advisers, objected to labor cost increases ranging from 23 percent to 54

percent on a food service contract. This action resulted in a significant reduction in the contract price. But more importantly, it reflects the spirit of our war on cost growth.

Problems to Overcome

Similar savings and actions on buys made by Systems Command were previously acknowledged by General Marsh (Commander, AFSC). Before we can truly get excited about our success stories, however, there are some serious problems we must overcome.

First, I don't believe we do a good enough job of evaluating contractor performance.

—We don't make effective use of Cost/Schedule Control Systems Criteria reports. We pay good money to obtain these reports, and we must take full advantage of the information they provide.
—Cost problems are a manifestation of technical problems.
—When you get the first indication of cost variance, don't come and ask for funding to cover it—find out what caused it and do something about it.
—We need to seriously question the unwarranted technical requirements sometimes imposed, and the minor engineering changes that end up creating major manufacturing problems, which delay programs and add to costs.
—We must become more proficient at evaluating the contractor's performance capabilities.

Second is the matter of increasing costs vs. quality.

—It doesn't have to be expensive to be a quality product.
—Emphasize quality control—look at scrap. The Air Force Contract Management Division should look at why and how much we are paying for scrap. How much money do you spend to do the work over again?
—Continue to examine people costs, particularly overhead. Higher headquarters should not have to request that studies and briefings in these areas be accomplished. How many times have we challenged whether the number of people on the factory floor are really needed?

Are we receiving quality work for the price we pay? Can I tell the public (with confidence) that the salaries we pay management are substantiated by the highly reliable, low-life-cycle-cost

products we buy? The bottom line is, we need to get more combat capability for the dollars we spend.

Third, we cannot afford what is in the Five-Year Defense Plan based on our normal way of doing business. The Office of Management and Budget (OMB) has just changed the inflation indices. All of the programs currently in the budget will receive less funding than planned. If you have a multiyear-funded program, you have a problem—or a real management challenge.
—Alternatives must reflect how we are going to cut costs.

Given these problems, we must be willing to face the following challenges:

—Cancel programs that have priced themselves out of the market.
—We may forsake some capability temporarily, but need to make the trade-offs and look for other affordable solutions.
—Fix what we've got. Make it work before we buy something new. That's what we are going to war with—not the new system in the future somewhere.
—Examine how we procure and, where necessary, have the guts to change. Seek newer and better methods to get the job done, and when confronted

with viable cost-saving innovations, renounce the "business as usual" approach. Make doable suggestions. Get more hard-nosed in a professional way.
—Let's publicize our accomplishments and reward our people for doing a good job. The public needs to know more than just the horror stories displayed by the news media. The same bad story has been a best seller for over a year now. We should get similar coverage for the quarter-of-a-billion-dollar savings on the F-16 multiyear or the $34 million savings on the 30mm ammunition multiyear buys.
—I wish there was some way we could stabilize our programs. Probably the greatest contributor to cost is the constant changing of programs—some by the Congress, some by OSD, and some by ourselves. If the F-15 had been procured on the originally planned schedule instead of the actual changed schedule, it would have cost $2 billion less. That's a whole wing we didn't get.
—Finally, let's support our Secretary. He is taking the tough position to enhance our credibility and to improve our warfighting capability.

Today, more than any time in our history, we must be prepared to confront and defeat the challenges that threaten our way of life.

DSMC Research Team Studies
'Managing for Success'

The Defense Systems Management College presently is conducting research on a project titled "Managing for Success." The primary objective is to identify common elements and patterns that seem to be present in successful weapon system acquisition programs, past and present.

The Joint Logistics Commanders, the Office of the Under Secretary of Defense for Research and Engineering, the Office of the Assistant Secretary of Defense (Comptroller), and several members of the DSMC Board of Visitors have been asked to nominate candidate programs for this research project. Approximately 12-15 will be selected to form a representative sample by type (aircraft, missiles, tanks, ships, etc.);

service (Army, Navy, Air Force, joint); and time (1960s, 1970s, 1980s). The program manager(s) and key personnel from each selected program will be interviewed to identify key factors that led to the success enjoyed by that program. Interviews will be conducted during June, July, and early August 1983.

Results will be presented at the 1983 Federal Acquisition Research Symposium, December 7-9, 1983, at Williamsburg, and will be published in future issues of Program Manager. The research project is led by J. Stanley Baumgartner, Patricia A. Kelley, and Calvin Brown of the DSMC Research Directorate, (703) 664-5783/4795 or Autovon 354-5783/4795.

"Parlez-Vous 'Ada'?"
An update of DOD's efforts to advance Ada as a standard computer language

Peter M. Fonash, Army Deputy Director, Ada Joint Program Office
Lieutenant Commander John F. Kramer, USN, Former Navy Deputy Director, Ada Joint Program Office
Lieutenant Colonel Vance A. Mall, USAF, Air Force Deputy Director, Ada Joint Program Office
Dr. Robert Mathis, Director, Ada Joint Program Office

The purpose of this paper is to summarize the status and goals of the DOD Ada[1] program. It does not provide the background or rationale for the Ada program, which has been more than adequately covered elsewhere, but it does discuss the function of the Ada Joint Program Office (AJPO) and the progress toward national and internationally recognized Ada standards.[2] Although minor modifications have been made to the language as a result of the standardization process, the basic functionality of the Ada language has been preserved. To protect the standard and to ensure conformance of implementation, DOD has established Ada as a trademark, copyrighted the reference manual, and developed a compiler validation capability.

Improving the quality and controlling the cost of software require the adoption of modern software engineering practices and a programming support environment that provides life-cycle support for application software. It will also be enhanced by the use of a single modern high-order language (Ada), which has software engineering as part of its design. Accordingly, the AJPO is promoting not only the use of Ada, but also standard life-cycle programming support environments. Two programming support developments are currently funded by DOD, the Army's Ada Language System (ALS), and the Air Force's Ada Integrated Environment (AIE). Efforts are under way to ensure the maximum transportability and interchange of tools among environments. A software library will be established to facilitate the reuse of common tools and application software.

Most of the technical problems associated with developing the Ada language and implementing compilers and standard programming support environments are understood. Of equal importance to the success of the Ada program is developing an Ada support infrastructure and providing the education and training required to permit the software community to maximize the cost-saving and quality-enhancing potential of Ada and DOD standard environments. The efforts aimed at resolving the remaining technical issues and promoting the successful adoption of Ada are summarized in Table I.

Ada Joint Program Office

The AJPO was established by the Under Secretary of Defense for Research and Engineering in December 1980, as a joint-service activity within the Office of the Secretary of Defense.[3] The primary responsibility of the AJPO is to manage the DOD Ada program by coordinating the military services' efforts to introduce Ada and Ada Programming Support Environments (APSE). The functions performed by the AJPO are as follows: (1) maintaining the Ada language standard; (2) developing common-use training and education materials; (3) validating Ada compilers; (4) fostering the use of Ada by the software community; and (5) developing Ada software tools to meet the common needs of the services and other DOD agencies.[4]

The DOD Software Program

The Ada program, by itself, will not solve DOD's software problems. The role of software in embedded computer systems is expanding, since software is increasingly becoming the DOD's primary method of increasing or modifying a weapon system's capability to reflect change in threat. The technology edge of the United States is used to compensate for numerical inferiority, but this technical superiority exacts a price—increasing complexity. The basic software problem is not our mismanagement of technology, but our inability to manage the complexity of our systems using existing software practices. Recognizing the need to improve its software business practices, DOD started the "Software Initiative," which has been subsumed into the Software Technology for Adaptable and Reliable Systems (STARS) program, to focus management resources

on the improvement of the software life-cycle practices and tools used in DOD computer systems. The Ada program is structured to provide the foundation for the STARS program. The Ada language, the Ada Programming Support Environments, and improved software engineering methodologies are a technology-infusion component of the software technology initiative. Software Initiative activities build on the Ada program, and coordination between the two efforts is the responsibility of the Deputy Under Secretary of Defense, Research and Advanced Technology.

Language Standardization

The language design team, CII Honeywell Bull, completed the language design, and the government published the *Reference Manual for the Ada Programming Language*, generally known as the *Language Reference Manual* or LRM, in July 1980. On December 10, 1980, the reference manual was republished by DOD as a military standard (MIL-STD 1815). Since that time, DOD has been working toward making Ada a universally recognized standard.

The AJPO has used the canvass process to establish Ada as an American National Standards Institute (ANSI) standard. The canvass procedure began in April 1981 when ANSI approved the canvassee list and the canvass package. The canvass package, including the July 1980 LRM and a ballot, was mailed to 96 organizations representing potential implementors, potential users, and general-interest categories.

The canvassees' responsibility was to vote on the acceptance of the *Language Reference Manual* as an ANSI standard. The rules of the canvass required reviews, votes, and comments to be returned within 6 months; accordingly, October 15, 1981, was established as the balloting deadline. The initial tally was 66 for making the proposed manual an ANSI standard; 23 against; and 7 not voting. A total of 380 comments were received.

Concurrent with the formal canvass, a public review was conducted. Although required by ANSI directives to consider only those comments made during a 2-month period, the Department of Defense initiated a public review in December 1980 and kept it open for a year. The public review was also expanded to include the interna-

Table I. Major Ada Efforts

Program Objective	Effort	Comments
Ensure the Definition And Maintenance of the Ada Language	Language Design	November 1982.
	ANSI Standard	February 17, 1983
	FIPS Standard	No activity.
	NATO Standard	Under way.
	ISO Standard	Initiated.
	Formal Semantic Definition	Clarify the language definition. This definition will be consistent with Ada validation test set.
	Operational Semantic Definition	Clarify the language definition and provide assistance to implementors to be consistent with and complement Ada validation test set.
	Implementors Guide	Clarify language definition and provide assistance to implementors.
	Ada Liaison Organization (ALO)	Provide a means to evaluate future language change proposals, provide an impartial mechanism for resolving validation disputes.
	Ada Validation Organization (AVO)	Will ensure standardization, by validating Ada compilers and KAPSE interfaces, evaluate language issues.
	DIANA	Development of a standard intermediate language which will facilitate development of code generators.
Establish Effective Business Environment	Ada Information Clearinghouse	Provide a facility to disseminate Ada information, promote the use of Ada.
	Participate in Users Groups	Cooperate with the software community to encourage use of Ada. Establish Ada Users Group.
	DOD Policies	Coordinate with appropriate DOD agencies the revision of existing policies and if necessary the issuance of new policies which foster the use of modern software engineering principles.
Provide Human Resources	Develop Ada Course Materials	Free distribution of Ada training/educational materials will assist in the development of an Ada software community.
	Develop APSE Training Materials	This will encourage development of a broad Ada community familiar with the advantages of an APSE.
	Style Guide	Guide to the proper Ada programming style, will promote the optimal use of the language by programmers.
	Conduct Ada Courses	Ada training for DOD personnel.
Provide Life-Cycle Support Systems	APSE	AIE, ALS development.
	Ada Software Design Methodology Formulation "Methodman"	Develop and encourage use of state-of-the-art software life-cycle methodologies.
	Research Into Standard Run-Time Support	Provide reusable run-time support packages.
	Ada Metrics	Develop an understanding of how Ada's features are used in applications.
	(a) Develop Reusable tools (b) Coordinate With AVO the Development of KAPSE-Tool Interface Standards (c) "Library" of Tools and Reusable Application Software Application	Significant potential for cost savings and increased reliability of software by providing a central repository for obtaining reusable software.
	Development of Math Packages	
	(d) Tool Taxonomy	Classification of software tools by application and purpose.

tional community in order to provide more visibility to those interested in considering Ada as a NATO and an International Standards Organization (ISO) standard. The 758 comments received from the public review were logged into a file and made available to the public via the ARPANET and TELENET electronic mail networks.

The language design team reviewed the public and canvass comments and, where appropriate, suggested Ada language modifications to resolve these issues. Under guidance from the AJPO, the language design team made language changes and proposed a set of chapter reviews documenting proposed changes to the *Language Reference Manual*. These chapter reviews received extensive analysis from an international group of expert computer scientists serving as Distinguished Reviewers for the Ada Program. The ANSI canvassees were advised of the resolution of issues they had raised and were given 30 days within which to change their vote based on their review of the proposed revisions, and an opportunity to register further disagreement. Only four canvassees indicated dissatisfaction with the revised Ada language, which represents convincing support for the language as revised.

As the next step in the language revision process, the language design team made changes to the LRM based on recommendations made by the Distinguished Reviewers. These changes reflected the agreed-upon changes in the Ada language. Although many of the changes addressed editorial rather than language-design issues, the number of changes made it appropriate for the canvassees to re-evaluate the revised reference manual. Therefore, DOD obtained ANSI approval for a supplemental canvass for editorial review only. No additional language changes were to be considered. The objective of the 2-month supplemental canvass, which began in July 1982, was to give the canvassees an opportunity to verify that the changes made to the LRM were consistent with their understanding of the revised language.

Although the canvass process has introduced changes to the language, there has been no change to its basic structure. A user will generally not perceive the changes, although he may observe simplifications in the underlying model and greater consistency in the design. One measure of the effect of the changes is shown by the following: Of

400 slides used in a course taught a number of times by the language designer, only four slides have been changed, and one has been eliminated.[5] On February 17, 1983, Ada was accepted as a ANSI standard.

The International Standards Organization (ISO) has taken the initiative of considering Ada for ISO standardization. The programming language subcommittee of ISO, ISO/TC97/SC5, recommended establishment in October 1981 of an experts group to consider Ada as an international standard. With an approval of Ada as an ANSI standard, the work of this experts group should proceed rapidly.

Ada is more than just another new language; it incorporates many features needed to support modern software engineering practices.

The European software community, which has actively participated in the language design and reviews and recognizes Ada as a state-of-the-art computer language, is very supportive of the Ada program. The European Economic Community (EEC) has adopted Ada as its common implementation language and the NATO community is considering Ada as a standard to facilitate interoperability of equipment, and to reduce NATO life-cycle embedded computer costs. The NATO Military Command and Control Information System Working Group (MCCISWG) established an *ad hoc* experts group to consider the implication of adopting Ada as the standard for NATO-funded portions of NATO command and control information systems. In addition, the Advisory Group for Aerospace Research and Development (AGARD) has a committee considering the use of Ada in NATO avionics systems.

In summary, Ada is an ANSI standard. The ISO and NATO standardization activities have been initiated and should occur within a few years. Standardization will provide stability for the development of a comprehensive environment and will promote reusable software. Although the Ada

language must remain stable to accomplish these goals, the AJPO recognized that there must be a formal mechanism to consider interpretations and, if appropriate, approve changes consistent with the requirements of ANSI. In response to this requirement, the AJPO is organizing an Ada Liaison Organization (ALO) with responsibilities and functions consistent with DOD, ANSI, and, eventually, ISO standardization maintenance requirements. The ALO will comprise interested parties from industry, NATO, and DOD, and will be chaired by the AJPO director.

Ada Programming Support Environment Development

Ada is more than just another new language: by design, it incorporates many features needed to support modern software engineering practices. An intrinsic principle of modern software engineering is the use of an automated environment that provides complete life-cycle software support. Recognizing the importance of an automated environment, DOD has established the goal of developing and maintaining all Ada software on state-of-the-art Ada Program Support Environments (APSE) that are based on the "Stoneman" model.[6] In the near term, DOD will support several APSEs to provide experience with different approaches to some of the newer aspects of programming support environments. Eventually, DOD will migrate to a standard environment that incorporates the best of its predecessors. The potential cost savings and quality improvement of Ada software will be realized when the use of a sophisticated APSE, complete with advanced development, maintenance, configuration control, and management tools is readily available to and widely accepted by the software community.

The purpose of the APSE is to support the development and maintenance of application software throughout its life cycle, with particular emphasis on software for embedded computer applications. An important concept in an APSE is the data base, which acts as the central repository for information associated with each project throughout the life cycle. The data base supports the organizational infrastructure and maintains the data critical to the development, testing, and life-cycle support of software. The data base also serves as the interface through which the modular tools communicate and in-

teract with one another. The data base will contain management information such as a version control, library support, and project management, as well as the code, test data, and documentation required as part of any life-cycle support.

A second important aspect of the APSE is its host-target structure. The host-target concept recognizes that many embedded computer systems are not appropriate for or capable of supporting software development and maintenance. In this concept, a much more capable machine (host) that can support the sophisticated and often resource-intensive tools required to support the life cycle of embedded computer software is used for development, testing, and maintenance of the operational software. Once developed, application software is transported to the target hardware for use. The host-target concept permits central development and maintenance of software intended for use on various kinds of hardware, thus reducing logistic problems and increasing productivity.

The Department of Defense has two Ada Programming Support Environment developments under way—the *Army Ada Language System (ALS)*, and the *Air Force Integrated Environment (AIE)*. It is the Navy's intention to provide a standard support environment and a corresponding run-time environment to meet the demands imposed by specific mission-critical requirements that will be based on the Ada language system. These efforts are for Minimal Ada Programming Support Environments (MAPSEs) because the AIE and ALS will make up the "minimal" tool set required for life-cycle support of software. Consistent with the Stoneman model, additional tools can, and will, be added to these environments.

The Army, with Navy and Air Force participation, will begin full integration testing of the ALS in 1983. The Army is planning to release the Ada Language Systems to U.S. firms, who will rehost/retarget the ALS using their own capital. The plan is that the ALS will be available for software development in January 1985. The ALS initially is hosted by Digital Equipment Corporation's VAX11/780 VMS. Additional tools will be added when requirements are determined. The AIE is schedules for delivery in 1984, with a

rehosted version available in 1985. The AIR will be hosted on the IBM 370. The AIE and the ALS initially will reside on different host-computer hardware, and will provide alternative design approaches that reduce overall program risk. Funding two developments ensures availability of a reliable support environment at the earliest feasible date. Eventually, the DOD will determine the best approach to APSE design, and the service APSEs will converge to a DOD standard.

Many Ada tool developments are under way or planned throughout the world. The Commission of the European Community awarded contracts for a root compiler and MAPSE. The German SPERBER project, supported by the German Ministry of Defense, will become a complete MAPSE with the inclusion of a data base in 1985. The British Ministry of Defense intends to partially fund an environment based on the extensive British MAPSE design studies completed in 1981 and 1982. In addition to these relatively complete MAPSE developments, numerous commercial Ada tool-set developments are under way.

The many early and pre-release versions of MAPSEs being developed today will begin to appear at user sites in 1983. Since these environment developments are fairly ambitious projects, they will probably require at least a year before they can be considered production quality for large projects. Furthermore, software life-cycle costs and quality may not demonstrate dramatic improvement with the introduction of these MAPSEs, since they incorporate new tools that will require time and experience to be used effectively and thus to provide significant improvement over existing environments. The MAPSEs have the potential, however, to be augmented at a reasonable cost with new and fairly sophisticated life-cycle Ada tools. As these tools are developed during the next decade by DOD and other Ada users, additional tools will transform the MAPSEs into APSEs, and significant improvements in the life-cycle cost and quality of developed software will become apparent.

The fundamental advantage of APSEs over existing environments is the potential for portable and reusable tools and application software packages. Reusable software should be

more reliable, because the software would be more thoroughly exercised, and reuse of software would reduce costs, because development and testing expenditures would be amortized over several projects. The DOD will establish several policies to promote reusable software. First, the AJPO will coordinate the establishment of a software "library" as a repository for tools and application packages; second, incentives will be instituted to motivate industry to develop Ada software that conforms to transportability standards and that is designed to be flexible enough to meet general needs.

Ensuring Tool Transportability

It is apparent that many APSEs will be developed, and that the initial development of several APSEs is beneficial. Competition will improve the quality of APSEs and the marketplace will determine the best design. Steps must be taken, however, to ensure maximum compatibility and tool- and data-portability between APSEs. The Stoneman model of an Ada Programming Support Environment requires all machine dependencies of the support environment to be contained in the Kernal Ada Programming Support Environment (KAPSE); anything outside the KAPSE is hardware independent. The purpose of the KAPSE is to interface the tools to the hardware. In order to promote compatability among support environments, the Navy has been tasked to lead a joint-service review team to identify and recommend conventions for the tool to interface: the review team has been named the KAPSE Interface Team (KIT). In addition, a volunteer international group of industry/academic experts (KITIA) has been established to support the KIT, and to provide an avenue for the non-DOD community to influence the KIT's directions. The KIT's success at identifying reasonable conventions and standards, and the degree to which KAPSE developers adhere to them will significantly influence the cost of transporting a tool from one KAPSE to another. Tool transportability will determine how well we can amortize the cost of sophisticated tool development across many installations.

The KIT's conventions will be reviewed by the KITIA and then made available to the public. The revised conventions will be the basis for the development of a KAPSE-tool interface test suite. The Ada Validation Of-

fice (AVO) will manage the establishment and administration of the test suite for validating KAPSE tool interfaces. The Departmetn of Defense will maximize tool transportability by ultimately requiring KAPSE tool interface validation of DOD-approved APSEs.

Compiler Validation

Enforcement of a single Ada standard is the only method available to ensure portability of embedded computer software at a reasonable cost, and this can only be achieved if every compiler conforms to the Ada standard. Accordingly, DOD will not use Ada subset, superset, or language variant compilers for the development or maintenance of DOD Ada software. An Ada Validation Office, reporting to the Technical Director, AJPO, will ensure that Ada compilers implement the standard, independent of hardware manufacturer.

Historically, the compiler implementation has been a *de facto* definition for the language. Consequently, when different compiler developers make divergent implementation decisions, dialects appear. The goal of the Ada program is to provide non-divergent implementations of Ada. This will be accomplished by maintaining a firm Ada standard represented by the Ada *Language Reference Manual*, publishing implementation, and guidelines for a powerful compiler validation capability. Since there is virtually no chance that two compilers will implement precisely the same language without some mechanical check, the AJPO has developed a sophisticated validation capability to test compiler conformance. There will be no restriction on the distribution of the validation test set. This is beneficial, not only because it will ensure conformance, but because it will be an enormously useful tool for implementors in that it will provide a considerable measure of confidence in the correctness of the implementation.

The *Implementor's Guide*, which is available to anyone interested, defines test objectives and discusses ramifications of critical sections of the *Language Reference Manual*. Almost 1,400 test objectives have been documented in the *Implementor's Guide*, and more than 1,700 tests have been written and tested. The complete set of approximately 1,600 test programs has been upgraded to reflect the language changes made during ANSI standardi-

zation. The *Implementor's Guide* is in the process of being updated to reflect the ANSI Ada standard and will be released shortly. The AJPO will continue improving the state-of-the-art in compiler valiation and the Ada test set. other validation tests may be developed in dependently, and, where practical, they will be used to augment the Ada Validation Office's test suite. Anyone may submit a test for inclusion in the test suite to the Ada Validation Office, which will evaluate the merits of adding the proposed test to the validation suite.

Ada validations are not intended to impose burdensome DOD regulations on the software communities; rather, validation is vital to the success of the Ada program in controlling cost, and improving the quality of software. The AJPO's policy is to minimize the compiler development effort required for validation. Validation guidelines that compiler developers must follow have been published and are available through the National Technical Information Service. The guidelines can be summarized as follows: A party submitting a compiler for validation will be responsible for any direct costs incurred by the AVO during validation testing. Compiler developers whose compilers successfully pass all tests will be issued a validation certificate that will be effective for 1 year. In order to assure continued conformance, annual validations of compilers will be required.

The AJPO has attempted to ensure that the test set correctly reflects the *Language Reference Manual*; however, interpretation issues may arise. The Director of the Validation Office will be responsible for resolving any differences between the AVO and a compiler sponsor. If the compiler sponsor is not satisfied with the AVO Director's decision, it may be appealed to the AJPO Director, who, with advice from the Ada Liaison Organization, an independent Ada language advisory group, will be the final decision authority.

Introduction Strategies

Ada will become a standard for development of future embedded computer systems. In the draft revised DOD Directive 5000.31, the use of Ada by all DOD agencies is strongly encouraged. In response, all DOD components are developing plans for the earliest feasible introduction of Ada. The introduction plan must take

into consideration that premature introduction may result in technical difficulties that could impact a weapon systems development. In light of this, Ada's introduction should be deliberate and well-planned in order to avoid as many initial start-up problems as possible.

The strategy for introducing Ada will vary with individual service and agency needs and capabilities. Although there is a long-term goal to adopt Ada as the common language for embedded computer applications, some components have a current commitment to other languages and support systems. Depending on the stability and sophistication of those systems within a DOD component, the component's strategy for the introduction of Ada will differ. A prerequisite to Ada's introduction is the development of the infrastructive for the configuration control, distribution, and maintenance of Ada software; education and training of programmers; education and training of DOD and industrial management; and establishment policies that promote modern software engineering practices.

When the ALS is mature and tested, the Army plans to use Ada and the ALS for all "battlefield automated systems" (i.e., any computer system that must be maintained/used on a battlefield). The Air Force pans to use Jovial J73 for avionics until an APSE is ready and then to use Ada at low program risk. The Navy plans to use CMS-2 until a Navy ALS is ready, and then to use Ada for all new system developments on the AN/UYK-43 and the AN/UYK-44.

Ada as a Software Standard

We anticipate that Ada will eventually become a standard in the non-DOD programming community, even though the DOD language Ada effort has been principally directed at the embedded computer system area, and has not addressed the traditional COBOL areas of financial management, inventory, or payroll, the FORTRAN domain of large scientific computations.

Because Ada is a modern programming language that embodies good software engineering principles and modern language features, there appears to be a growing recognition that Ada is suitable for areas other than the embedded computer applications on which it was designed. Although the

AJPO is principally concerned with the application of Ada to embedded computer software, and embedded computer support systems, it will continue to encourage the use of Ada and related software standards (i.e., validated Ada compiler, KAPSE standards, Ada style guide, standard support environment) by the federal government and the entire software community.[7]

Several commercial firms are currently developing Ada compilers. We anticipate that all major hardware manufacturers will design and develop Ada compilers, and that many will develop Ada programming support environments. Intel has chosen Ada as the standard language in its new generation of microprocessors, the IAPX 432. A Finnish firm, Nokia Data of Helsinki, is marketing a 32-bit super minicomputer using Ada as its native language. The Japanese and the European Economic Community are spending millions of dollars on Ada development efforts. Currently, at least 36 American and foreign organizations are involved in Ada development efforts.[8] One software vending firm, Intellimac, already markets financial systems written in Ada using an incomplete, commercially developed Ada compiler.

Public Access to Ada

Permitting public review of the Ada program has resulted in the knowledge and experience of the entire software community contributing to its development. This facilitates the best possible Ada products, and increases the support of the software community. Consistent with the public access to the Ada program, DOD will make DOD-funded non-classified application software available to the public within the constraints of export control policies.

Acceptance of Ada by the software community has been facilitated by the endorsement and support of software affinity groups (e.g., academics, users, implementors, management, and non-DOD user groups). Active participation in these affinity groups by DOD has provided positive interaction and feedback between DOD and the software community. Currently, DOD maintains an active interface with the Jovial Ada Users group, Ada Europe, AdaTec (an Ada users/implementors group), and with the various standards groups (e.g., American National Standards Institute, International Standards Organization, and NATO).

In addition to cooperation with affinity groups, the AJPO has established an information clearinghouse to maximize public knowledge and interaction in the Ada program. Removing institutional barriers to the adoption of Ada will speed the acceptance of Ada, its environment, and modern software engineering practices. Because potential users are not familiar with the advantage of Ada, they will either resist the use of Ada or design new systems in Ada using old practices. The former would slow the introduction of Ada, and the latter would reduce the cost and quality goals of the program. Providing information to and interacting with the software community will increase awareness of Ada's benefits and will provide the knowledge required to take full advantage of Ada's technology. Timely, accurate information will eliminate many of the misconceptions inherent in technology introduction.

The Ada information clearinghouse will utilize an automated data base management system that will contain information on publications, events, activities, and contracts relevant to the Ada program. The clearinghouse will also maintain reference and historical Ada publication libraries. All information will be available to the public.

Notes

1. Ada is a registered trademark of the U.S. Department of Defense (Ada Joint Program Office).

2. See William E. Carlson, et al., Proceedings of the Annual Conference, December 27-29, 1980, Association for Computing Machinery: Institute for Electrical and Electronic Engineers, Computer, June 1981 (a special issue devoted to Ada); and James Fawcette, Ada Goes to Work," Defense Electronics, July 1982.

3. Under Secretary of Defense Memorandum, Subject: Ada Joint Program Office (AJPO), December 12, 1980.

4. Department of Defense Charter for the Ada Joint Program Office, December 1980.

5. For an excellent summary of the changes made to the Ada language as a result of the ANSI standardization process, see "Summary of Ada Language Changes," Ada Letters, March-April, Vol. 1, No. 3.

6. Department of Defense. "Department of Defense Requirements for Ada Programming Support Environments—Stoneman." February 1980.

7. On April 11, 1983, the NYU interpreter/translator was validated by the AJPO, and on June 13, 1983, the ROLM Corp. and Data General received validation certificates.

8. Association for Computing Machinery. Ada Letters, March-April, Vol. 1, No. 3.

A Simple Way to Dis-communicate at Work

Most business executives are learning how to *connect* better with people. But what about the times you want to *dis-connect?* When you need office privacy to get a proposal mapped out but people keep coming in and interrupting you?

Two "communication languages" can help: furniture language and body language. According to the study "Privacy in Public and Semipublic Places," commissioned by GF Business Equipment of Youngstown, Ohio, you can:

—Create a maze through your office with plants, chairs, tables, partitions, files, and a typewriter. Visitors have difficulty finding the route to your immediate presence.

—Have enough personal memorabilia around (photographs, etc.) to buttress your intimate zone. A visitor knows he's intruding on your private space and won't push in too far.

—Keep all spare chairs covered with files and papers.

You also have ways to turn off conversations with your body language, says the study:

—Don't put your pen down; it reminds the visitor you're in the middle of important business.

—Cradle the phone on your shoulder.

—Stand up.

—Avoid eye communication; conversations don't sustain without eye contact.

Or you could to what you probably do anyway: get your best quiet work done before 8:00 a.m. and after 7:00 p.m., when nobody's around.

(Decker Communications Report)

Taking the
Heartburn
Out of CS²

Joseph R. Varady, Jr., and Mark J. Lumer

To many contractors Cost/Schedule Control Systems Criteria (CS²) is a four-letter word, ranking just slightly above "technically unacceptable" and "defective pricing" in popularity. To government personnel charged with ensuring that reluctant contractors comply, it is a confusing, complex system that smacks of the square peg in the round hole—it just doesn't work.

We believe there is an equitable way to eliminate contractor reluctance to implement CS² and to create a positive contractor attitude. The method is simply a combination of training (his) and money (the government's).

Department of Defense Instructions (DODI) 7000.2 and 7000.10 mandate CS² incorporation in all major systems acquisitions (excluding fixed price and fixed price with escalation), as defined by DOD Directive 5000.1 and Office of Management and Budget (OMB) Circular A-109, and all other programs with estimated RDT&E cost in excess of $75 million or estimated production cost in excess of $300 million. The Army has lowered this threshold to in excess of $25 million in development or $100 million in production.

Defense Acquisition Regulation (DAR) 7-104.87 (September 1979) is the contractual implementation of these instructions and directives. The clause states that: "Prior to acceptance by the Contracting Officer and within ninety* (90) (* or as otherwise agreed to by the parties) calendar days after contract award, the Contractor shall be prepared to demonstrate the operation of his systems to the Government to verify that the proposed systems meet the criteria set forth above." In a subsequent paragraph the clause also states, "When systems existing at time of contract award do not comply with the criteria, adjustments necessary to assure compliance will be effected at no change in contract price or fee."

Contractors have many reasons for not putting on CS²—funds, lack of penalties for not performing, emotionalism, lack of ability, etc. In general, a lack of incentive (money) and knowledge (instructions) are the basic reasons for CS² difficulties.

We propose a three-pronged approach towards the timely implementation of CS², as follows:

1. An award fee for implementation and management of the CS² program throughout the life of the contract.

2. A formal course of instruction for key contractor personnel, to be set forth as a contractual requirement.

3. A withholding of (any) fee until CS² is fully implemented.

Let's discuss each in more detail:

Award Fee

DAR 3-405.5(h) states: "In certain cases, it may be desirable to motivate and reward a contractor for management performance over and above that which can be objectively measured and incentivized under other forms of government contracts. For example, logistics support, quality, timeliness, cooperation, ingenuity, and cost effectiveness are areas under the control of management which may be susceptible only to subjective measurements and evaluation. In such cases, the 'award amount' portion of the fee applicable to the CPAF contract is an *ideal* method for incorporation of these additional incentives into Government contracts . . ." [emphasis added]. The award fee for CS² would include timely validation and correct monthly Cost Performance Report (CPR) submissions. Major errors in reporting or a protracted validation process would reduce the fee.

There are significant advantages to both the government and the contractor using award fee for CS² implementation. The contractor is given a clearcut objective and an identifiable profit/fee for achievement. Since experience has indicated that successful implementation for CS² is a combination of training and corporate emphasis, a program manager would have difficulty explaining to his management why he failed to earn the fee offered by the government. Conversely, the reward to a manager for increasing profit/fee, upgrading his workforce's training and professional capabilities, while at the same time satisfying the customer's requirement, should be substantial.

On the government's side, early, successful implementation of CS² gives DOD greater trackability and visibility, shows the contractor's willingness to cooperate, and helps the contractor's profit/ROI picture. If a contractor voluntarily forsakes his fee, the government's future negotiating position *vis-à-vis* fee should be greatly enhanced by the contractor's non-effort. Moreover, since the fee-determining official can unilaterally reduce or eliminate the fee, the government can send a strong signal to corporate management that they have a very un-

Mr. Varady is Director of Procurement, U.S. Army Communications-Electronics Command, Fort Monmouth, N.J.

Mr. Lumer is a contracting officer in the Fort Monmouth Contracts Office, U.S. Army Electronics Research and Development Command.

happy customer. It should be noted that award fee determinations are not appealable under the Disputes Act.

Using award fees for CS^2 is fully consistent with the DOD Acquisition Improvement Program as set forth by former Deputy Secretary of Defense Frank C. Carlucci. In particular, this program supports, through added profit, the encouragement of capital investment (Action 5), will assist the government in budgeting to most likely costs (No. 6) by incentivizing early adoption of a realistic cost tracking system, provides a documentation of contractor performance on a continuing task for future evaluations to improve the source selection process (No. 20), and in general allows a greater return on investment, which should help foster a wider industrial base.

An added benefit of effective CS^2 implementation will be the ease with which a program or project manager can respond to the requirements of the so-called "Nunn Amendment," which cuts off funds for major weapon systems if a PM suspects or knows of cost growths of 15 or 25 percent, as applicable. Better data will enable a PM to stop the hemorrhage of dollars earlier in the program because the CPR has redflagged the problem. As an aside, it is surprising to note that our experience indicates that the contractor's PMs are often equally unaware of serious dollar growths. Since these managers are usually concerned with bottom-line numbers, a serious problem might be offset by economies or outstanding performance in another area, effectively camouflaging the growth. Early CS^2 implementation would highlight each area of work.

Formal Course of Instruction

It is clear from involvement in implementing CS^2 with several contractors that they have no idea who gets, reads, or grades the report. Many contractors believe that the CPR submissions are just piled on top of the dozens (or hundreds) of other data item reports that serve only to keep dust off an 8-by 11-inch piece of desk. Without commenting on this widely held view that most of the contractor submittals are simply sent to the files unread, it must be emphasized by the government to the contractors that CPRs are not in this category. These reports have tremendous exposure up through the

highest levels of the Defense Department, and contractors must become aware that these reports are read, thoroughly analyzed, and briefed to people who can kill programs with the stroke of a pen. Inaccurate, shoddy, and contradictory submissions reflect very poorly on the company itself, the company's program manager and his staff, and question the firm's ability to control costs and meet schedules.

To resolve this problem, we propose sending contractors to school. The Defense Systems Management College (DSMC) at Fort Belvoir, Va., teaches an excellent 1-week Contractor Performance Measurement Course. The curriculum includes lectures from guest speakers from the Office of the Secretary of Defense (Comptroller), and the three services, who explain how they use CS^2 data. Contractors catch on quickly when the gentleman from OSD flashes a graph of the company's performance on the screen and comments, "Behind schedule, over cost—an excellent candidate for cancellation!" On one of our major programs three contractor employees have attended the course, with beneficial results accruing to the government. Almost instantaneously, CPR submissions improved, management motivation increased, and a major government-contractor area of contention was eliminated, simply because the company finally understood what the government did with the data, and

what importance the government attached to it.

Withholding of Fee

Despite monetary incentive and an understanding of the government's use of CS^2, some contractors will still resist "government interference in how they run their business." For these companies, a negative incentive must be used. DAR 7-203.4 and 7-402.3 permit withholding up to 15 percent or $100,000 in fee, whichever is less, under cost-reimbursement supply and R&D contracts. Until the contractor gets validated and submits accurate reports, the money is frozen. If he never complies, he never gets the money.

What if a company is willing to give away award fee, risk cancellation, and doesn't care about $100,000, and just refuses to implement CS^2? The clause should be rewritten to add termination for default language, and then the government should set a real precedent. Additionally, this non-compliance and failure to perform would be highlighted in all pre-award surveys and contractor evaluations, and as factual evidence when evaluating "past performance" in a given solicitation.

In summary, CS^2 can work to develop a mutually beneficial work partnership, or be a devisive force fostering an adversarial relationship. It all depends on how it is used.

DARCOM to Merge Six Commands Into Three

The U.S. Army Materiel Development and Readiness Command (DARCOM) plans to strengthen and simplify its management structure by merging six existing commands into three new commands.

Total employment is expected to remain at the current level for each location involved, with no resultant relocation of people.

A U.S. Army Aviation Systems Command (AVSCOM) will be created by consolidating the U.S. Army Aviation Research and Development Command (AVRADCOM) with the aviation elements of the U.S. Army Troop Support and Aviation Materiel Readiness Command (TSARCOM). The remaining elements of TSARCOM will

merge with the U.S. Army Mobility Equipment Research and Development Command (MERADCOM), and the Natick Research and Development Laboratories (NLABS) to form the U.S. Army Troop Support Command (TROSCOM).

The third new command, the U.S. Army Armament, Munitions and Chemical Command (AMCCOM), will be created by merging the U.S. Army Armament Research and Development and the Armament Materiel Readiness Commands (ARRADCOM and ARRCOM).

The headquarters for AVRADCOM and TSARCOM are in St. Louis. Fort Belvoir, Va., is home for MERAD-

The Cost of C/SCSC

Owen C. Gadeken
Thomas S. Tison

Cost Schedule Control Systems Criteria (C SCSC or CS² or "the criteria") have been evolving in the Department of Defense (DOD) for more than 20 years. Although the process has now been almost institutionalized within DOD, its effectiveness is still the subject of some controversy within both government and defense industry. In this paper, we first review the highlights of the evolution and development of CS², then analyze its cost impact using the approach of analyzing the effect of hypothetical implementation of CS² on a hypothetical well-managed company. Finally, we draw some conclusions from our analysis and present recommendations that we feel will improve the application and acceptance of CS² within the DOD community.

Background

Program Evaluation and Review Technique (PERT)

The development of the criteria approach to project control began with the Program Evaluation and Review Technique. This was a network scheduling technique developed during the later 1950s and early 1960s by the Navy for use in managing the Polaris Fleet Ballistic Missile program. It was useful because it graphically displayed the interrelationships of specific program activities and established the critical path or paths through the net-

work for management to focus its attention. Next, a version called PERT COST was developed. which added the capability to budget and report costs by PERT network activities. As PERT and PERT COST evolved, they often became identified with specific sets of computer hardware and software. By 1964 several variations of PERT COST existed throughout DOD, most of which called for separate costing of PERT network activities and the submission of detailed monthly cost reports to the government.[1]
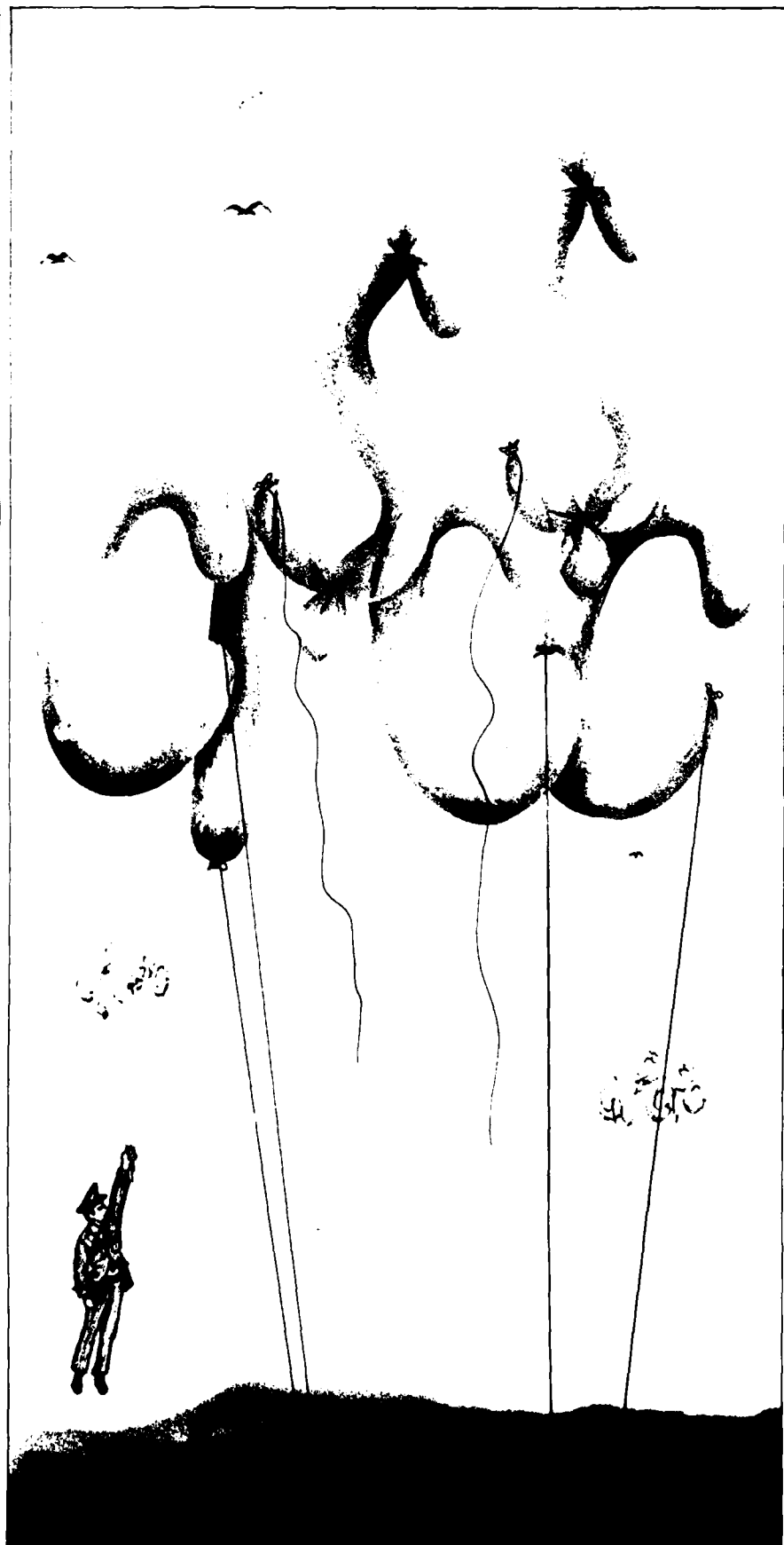
Contractors early on recognized the impracticality of these PERT COST systems and created special PERT COST groups to prepare reports for the Defense Department. These groups often operated separately from the management teams responsible for actually planning, scheduling, budgeting, and measuring program performance. Many contractors used PERT COST groups as the basis for negotiating higher overhead rates and were then able to produce a larger cost base for profit negotiations. Government auditors properly decided that PERT COST groups were a legitimate overhead expense that could be charged to the government.[2]

Further, PERT COST requirements were often negotiated into contracts on top of perfectly valid existing contractor management and control systems. The end result was frequently a redundant information processing and reporting system developed solely to satisfy the government's PERT COST requirements. Reports provided to the government generally were not derived from contractors' actual management and control systems. Consequently. these reports often did not reflect the true status of their projects.

While PERT COST foundered, two different Air Force groups were pursuing independent but interrelated activities to design and implement a criteria-based approach for obtaining project status information.

Earned Value — Air Force Minuteman Program Office

In 1963 the Air Force Minuteman missile program office, working with a group that later became known as Performance Technology Corporation, developed a contractor performance measurement concept based on a set of management criteria to be included in the contract statement of work. This

concept carried over the work breakdown structure and work package ideas from PERT COST and added several improvements. It was designated the "earned value" concept.[1] Earned value refers to the work actually accomplished measured in terms of the budget planned for that work. The earned value system used the lessons learned from PERT COST by stating the general capabilities required of contractor's internal project management systems instead of requiring or imposing specific and detailed government systems.

Another of the Minuteman program's major contributions was the recognition that implementation of the criteria approach required a realistic appraisal of contractor's internal project management systems in operation. Thus, the concept of on-site "systems demonstration" was introduced, a concept calling for the examination and validation of contractors' internal planning and control systems.[4]

Cost Schedule Planning and Control Specification — Department of the Air Force

Paralleling the Minuteman program efforts, a second group within the Office of the Secretary of the Air Force was working to define a set of simplified standards by which to measure a contractor's internal management systems to quality the company to do defense work. The specification developed by this group contained the essential elements of the PERT COST and earned value approaches but avoided detailed cost reporting from PERT networks. The resulting Cost Schedule and Control Specification (C-Spec) was published by Air Force Systems Command in June 1966.

Cost Schedule Control Systems Criteria — Department of Defense

In December 1967, DOD Instruction 7000.2, which includes the Cost Schedule Control Systems Criteria (C SCSC), was published by the Assistant Secretary of Defense (Comp-

Owen C. Gadeken is a Professor of Acquisition Management in the Policy and Organization Management Department. Defense Systems Management College.

Thomas S. Tison is a systems engineer with the Department of Energy's Oak Ridge Operations Office.

troller). The underlying purpose of the instruction was twofold: (1) to itemize those precepts or criteria that any contractor's project management control system should embody; and (2) to enumerate clearly that a necessary characteristic of any acceptable project management control system is reliable, integrated cost schedule performance measurement.

The policy requirement for integrated cost schedule performance measurement had evolved in the Department of Defense. Yet, at the time DOD Instruction 7000.2 was issued, there was little formal material in existence that described or explained the earned value concept and how it could be consistently applied. Therefore, DOD Instruction 7000.2 authorized the preparation of a guide for performance measurement. A Tri-Service C SCSC Joint Implementation Guide was issued in August 1970. The Guide has been updated three times since then, in 1972. 1976, and most recently in October 1980. Initially, there was some difference or resistance to the criteria concept in the services and in industry, primarily as a result of their PERT COST experience. By 1972, however, all three services were actively implementing C SCSC.[5] In addition, the criteria concept now has been adopted by many other federal agencies including NASA, the Department of Transportation, and the Department of Energy. Thus, C SCSC moved from one project, to one service, to one department, to many departments and agencies throughout the government.

The C SCSC Approach

While the use of management criteria has evolved relatively recently, such an approach essentially is similar to the use of engineering specifications and design criteria, which is a commonplace and accepted part of the systems engineering process. The engineering specification criteria approach basically says — build me a piece of equipment, a facility, a data processing system, or a road that will conform to the following specifications: length, width, reliability, maintainability, capacity, speed, output, control, and so on. The contractor then has the flexibility to propose any design as long as it meets the specifications. The specification criteria approach to project management says much the same thing: provide management systems that allow for control of the project by

developing valid, clear standards and then managing by the exceptions to those standards, which can provide *timely* information and respond quickly to project changes, and which can provide *reliable* information to managers—reliable in the sense that it summarizes and is representative of what is really going on at the foreman, draftsman, or individual worker level and is appropriate for the level of management reviewing it.°

The Cost/Schedule Control Systems Criteria are not a management system, nor do they provide specific methods of organization or operation. They are intended to serve as standards for evaluating the adequacy of contractor project management control systems. Contractors are encouraged to organize in the manner best suited to their individual environments and may establish and operate to the internal methods and procedures of their choice.˜ The basic concept embodied in C SCSC is that if the contractor operates a sound cost schedule control system for his own use, the government program office should be able to extract summary information from that same system to meet government requirements for project status information. Through this approach, the program office should be able to avoid imposing expensive and, to some degree, duplicative systems on its contractors.
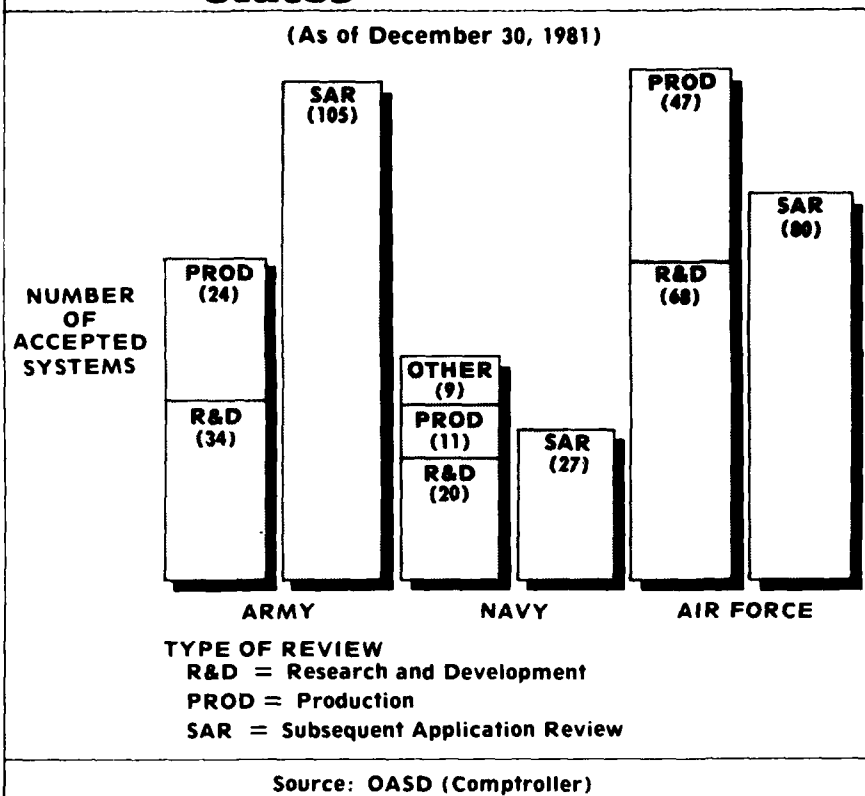
The contractor's management control systems can be manual, automated, or a combination of both, as long as they result in an integrated management system. However, this system must have the capabilities specified in the criteria in order to be acceptable.⁸ It is important to note that the criteria themselves do not require the submission of any reports to the government, but specify the reporting capabilities contractors' internal systems must have and the types of data that the systems should be able to produce. The type and detail of reports are then selected by the government program office after considering individual service and program requirements.

Current Status of C/SCSC Implementation

The current status of C/SCSC implementation is illustrated in Figure 1. Even though the numbers are impressive, problems exist that are cause for concern. Avenues for contractor feedback and opinion such as the National

Figure 1. C/SCSC Implementation Status

(As of December 30, 1981)

NUMBER OF ACCEPTED SYSTEMS

ARMY: PROD (24), R&D (34), SAR (105)

NAVY: OTHER (9), PROD (11), R&D (20), SAR (27)

AIR FORCE: PROD (47), R&D (68), SAR (80)

TYPE OF REVIEW
R&D = Research and Development
PROD = Production
SAR = Subsequent Application Review

Source: OASD (Comptroller)

Security Industrial Association, defense industry symposia, and *ad hoc* committees repeatedly highlight that (1) there are still areas of the criteria that need improvement, and (2) favorable contractor attitude and acceptance of the criteria is not universal.° Many contractors seriously question the cost effectiveness of C SCSC at the level of detail it is applied on many programs. Some DOD managers also question the benefits vs. cost of C/SCSC.

Assessing the effectiveness (or benefits) vs. the cost of the C/SCSC is particularly difficult because both the benefits and costs involved are almost impossible to quantify. The benefits of C/SCSC are good cost schedule control of a project, but quantifying such benefits is the same as trying to answer the question "What is the value of good management?" Even in an isolated analysis of a specific contract, benefits of using C/SCSC cannot be clearly associated with results in terms of improved technical performance, increased quality, shortened schedule, or contract cost savings, let alone quantified into one cost figure.

At first glance, it would appear that the cost of C/SCSC should be more readily determinable. But problems also exist here. Costs uniquely attributable to C/SCSC such as support of validation reviews and system description documentation may be clearly identifiable and directly associated with C SCSC. However, how about planning and budgeting, variance analysis, change control, and other day-to-day management activities? All are required by C SCSC, but the cost of such activities is also part of the normal management process. Not only is measuring the cost of these functions almost impossible, but equally difficult is trying to decide what part to attribute to C SCSC. Since contractors facing the C SCSC contractual requirements for the first time have widely differing project management systems and procedures, the extent to which they must modify their systems to comply with the criteria also will vary considerably. The extent of this variation is further compounded by the government review team's rigor or level of detail in interpreting the criteria. A final complicating factor in cost measurement is the attitude of the con-

Program Manager

tractor when he reports costs attributable to C/SCSC. Contractors who see a value in using the criteria are more likely to minimize the inclusion of general management costs in their totals. On the other hand, contractors who do not accept the criteria are likely to attribute even remotely related costs to their total cost of compliance. Examination of past studies of the cost of C/SCSC, which also include contractor comments, strongly suggests that the above type of bias is present in such cost data. In summary, the inability to measure and attribute costs of management functions to C/SCSC and the variables of initial company management systems, company size, contract value, government criteria interpretation, and attitude/acceptance make quantification of the costs of implementing C/SCSC infeasible.

So far, the discussion has tended to a conclusion that the cost of the C/SCSC contractual requirement cannot be accurately quantified. While we believe that there are inherent difficulties and weaknesses in any approach that attempts to quantify the cost of management criteria, we feel that determining the major cost elements associated with C/SCSC is still an important objective. In the remainder of this paper, we examine the cost impact of C/SCSC from a different perspective—that of a hypothetical well-managed company facing the C/SCSC contractual requirement for the first time. This treatment avoids many of the problem areas discussed above because it is generic rather than based on specific contractor experience or historical contract data.

Our approach qualitatively evaluates the impacts of C/SCSC implementation, i.e., what specific project management systems and procedures would a well-managed company have to institute or alter to comply with the criteria? Our initial assumption is that the company has a completely integrated management and control system that has made it successful in the commercial sector. This assumption will allow us to focus on any unique aspects in the C/SCSC that are not normally required of a well-managed commercial company. While our approach does reduce the impact of many of the variables mentioned above, it does have weaknesses. There is no such thing as an ideal, well-managed company; all companies have specific characteristics with a mixture of managerial strengths and weaknesses. Also,

our anlaysis of the well-managed company is highly subjective. And finally, we still do not quantify the costs or range of costs of implementing C/SCSC. But we do feel there is merit in looking at the C/SCSC cost issue from this different frame of reference because it can highlight the major cost elements that will affect any implementation of C/SCSC.

C/SCSC vs. One Hypothetical Well-Managed Company

In our analysis, we first evaluate a well-managed company in each of the five criteria areas and then discuss some other more general problems that our hypothetical company would face in complying with C/SCSC.

Organizational Criteria[10]

These criteria require the contractor to define all work to be performed under the contract and to assign this work to the organizations responsible for performing it. This must be done using a contract work breakdown structure (CWBS). The key element in these criteria is the requirement to clearly assign responsibility for identified work to the appropriate functional organization. Examined closely, these criteria simply reflect basic management principles: definition of work into smaller, manageable tasks, and assignment of that work to specific organization elements. Any well-managed company should be able to meet these criteria with minimal effort.

Planning and Budgeting Criteria[11]

These criteria require that all authorized work be planned, scheduled, budgeted, and authorized. This means that the contractor must have (1) a scheduling system that identifies key decision points, constraints, and interfaces; (2) a budgeting system that assigns the total budget to CWBS elements and functional organizations; and (3) a work authorization system that defines the scope of work and assigns it to functional organizations responsible for performing it. Key to these criteria is the establishment of a time-phased budget baseline known as the performance measurement baseline.

On close examination it is apparent that these criteria, like the organizational criteria, are also based on sound management principles. Tasks must be planned and scheduled, budgets assigned, and work authorized. These

fundamental practices are found in any well-managed company. Certainly in the process of accomplishing a project, detailed tasks must be planned and controlled. But the questions here are how detailed and how formal? Many of the criteria in this section refer to cost accounts and work packages; the implementation guide contains such terms as detailed tasks, level at which work is being performed, and short-span duration. Implied in this terminology is a level of detail and formality that may or may not be found in a well-managed company.

Accounting Criteria[12]

These criteria require that the contractor's accounting system record all direct and indirect costs applicable to the contract. Contractors must be able to summarize cost from the level at which they are applied up through both the work breakdown structure and functional organizational structure.

A review of these criteria shows that, except for one area, the requirements for the hypothetical company's accounting system will be essentially those required by the Defense Contract Audit Agency (DCAA) for all defense contractors. The one area that does go further than "generally accepted accounting practices" is that of material accounting. The criteria state that material costs can be handled by one of two methods—"applied" or "other acceptable basis." For the "applied" method, credit for material is taken at the point of usage (i.e., consumption, installation, etc.). For most companies, this point of usage is an addition to existing accounting practices. For the "other acceptable basis" method, special efforts must be made to avoid distortions in the value of credit taken for material. Using either method, companies must be able to relate material costs to work performed. Although not revolutionary concepts, these criteria require many companies to add practices and procedures to handle the various types of materials used on their defense contracts.

Analysis Criteria[13]

These criteria establish the characteristics that contractors' systems must possess, and specify the type of data that should be derived from the contractors' systems to adequately measure and address performance. Terms such as budgeted cost for work

scheduled (BCWS), budgeted cost for work performed (BCWP), actual cost of work performed (ACWP), budget at completion (BAC), and estimate at completion (EAC) are introduced. The criteria require that the contractors' systems be capable of summarizing these elements and associated variances from a relatively low level (cost account) up through the WBS and the functional organizations. The criteria require that the contractors' systems have the capability to identify the cost and schedule variances at the cost-account level and that analysis be provided if pre-established thresholds are exceeded. In summary, these criteria require a comparison of actual vs. planned performance, calculation of variances, and analysis of variances (if they exceed predetermined thresholds).

Unsuspecting individuals are likely to reach for the "panic button" when first reading the analysis section of the criteria. First, and maybe foremost, is the terminology introduced in these criteria. Terms such as BCWS, BCWP, and ACWP are not commonly used by companies. But a close examination of the definition of these terms indicates that most of these data elements exist in companies in one form or another. One major exception is BCWP (the cornerstone of the earned-value concept). Budget cost for work performed involves the determination of a value for all work accomplished during a given period. The major difficulty encountered in this determination is the value placed on partially completed work (i.e., an evaluation of work in process).

All companies measure performance. They assess and assign value to the work that has been performed, including work-in-process. Therefore, some type of earned-value concept exists in all companies. But do companies have formal methods established and adhered to that would meet the criteria requirements and the implementation guidelines for BCWP? In our opinion, most well-managed companies do not. The formal establishment of methods to take credit for BCWP and the level of detail implied in the Joint Implementation Guide would not, in all possibility, be found in a well-managed company. (Note: The utility of measuring performance using consistent earned-value methods in accordance with the criteria is not immediately recognized by most companies. However, we have

observed that once compliant management systems have been established and successfully used, company attitudes change from reluctant acceptance to advocacy.)

Revisions and Access to Data[14]

These criteria require the contractor to do basically two things: (1) maintain a valid performance measurement baseline, and (2) provide government access to internal data. Maintenance of a performance measurement baseline requires that a contractor establish formal ground rules for revising the baseline. This includes incorporation of changes authorized by the government and changes due to internal replanning. Procedures for change control must also be established. Although well-managed companies may not have practices and procedures that would satisfy these criteria, it should not be too difficult to comply. Once a performance measurement baseline is established, these procedures for maintenance of the baseline are a natural follow-up. Finally, companies must provide the contracting officer and his duly authorized representative access to appropriate contractor data. This poses no major additional burden on a DOD contractor.

Implementation

In addition to the review of the criteria, it is necessary to review how DOD implements C/SCSC. Normally, on a large contract for which a full validation is expected, a team of seven to fifteen individuals is appointed and given the responsibility of validating the contractor management system's adherence to C/SCSC. Ideally, an experienced individual is chosen as the team leader and at least four to five individuals with some C/SCSC validation background are placed on the team. Unfortunately, some teams are composed of individuals with little or no training and no validation experience. This creates a situation that is a nightmare for both the team chief and the contractor. With little training or experience, team members go to the criteria and implementation guidelines expecting the contractor's system to meet explicitly every detail and subquestion of the criteria checklist. If the contractor's system doesn't explicitly meet "the letter of the criteria," he is cited for noncompliance. Rigid interpretation of the criteria is the cause of continuing disagreement between DOD and industry.[15]

Conclusion

In our review of a hypothetical, well-managed company, we concluded that there are cost impacts when C/SCSC is imposed. Although it is almost impossible to quantify these costs because of the many variables involved, it is possible to identify the major cost drivers and their sources. These are summarized in Figure 2. A major DOD objective in using C/SCSC should be to recognize these cost drivers and work to minimize their impact. The following recommendations are made to help achieve this objective.

Recommendations

Implementation Team Relationships with the Contractor

Many of the costs associated with C/SCSC are a direct result of the implementation process, the team leader, and members. An important DOD objective is to ensure that knowledgeable, experienced C/SCSC team leaders and team members are appointed. All services need to re-emphasize this objective. In addition, team leaders need to recognize that their team decisions can become a major source of implementation costs to the contractor. Team leaders should be encouraged to work closely with their contractors by: (1) initiating early communications, (2) explaining terminology and concepts, and (3) recognizing the peculiarities of contractor systems. In essence, the team leader should be willing to "roll up his sleeves" and work closely with contractor personnel from contract award through the C/SCSC demonstration. This is not as a consultant, but in the capacity of clearly explaining terminology and assisting the contractor in fully understanding the C/SCSC requirement.

Training

Contractors complain that there are too many untrained government members on the C/SCSC review teams. In our opinion, this does not result from lack of training opportunities. Several C/SCSC training courses are available within DOD. These courses, which have been refined over the years, are vital and must be continued. They also should be put in a form such as programmed learning texts suitable for dissemination to the

Figure 2. C/SCSC Cost Drivers

SOURCE	COST IMPACT	
	MAJOR	MINOR
CRITERIA	EARNED VALUE	TERMINOLOGY MATERIAL ACCOUNTABILITY CHANGE CONTROL
IMPLEMENTATION	LEVEL OF DETAIL RIGID INTERPRETATION	TERMINOLOGY

maximum number of field locations. The Defense Systems Management College has already done this with its Contractor Performance Measurement Course (CPMC). In addition, this training should be supplemented to ensure that the latest information (guideline updates, issues, problem areas, etc.) is provided to the field. As a goal, we recommend development of a set of courses and update information that could be grouped and tailored to meet the exact needs of different individuals or field locations.

Both existing and newly developed courses should stress the use of good judgment in applying and interpreting the criteria when reviewing contractor's systems. The criteria approach was purposely taken by DOD to allow flexibility in acceptance of contractor management and control systems. However there is a need for experienced leaders in both formal training programs and on implementation teams who can impact this sense of flexibility to new review team members. The policy of flexibility and judgment in application should be the major underlying theme in our C/SCSC training program.

Summary

Cost/Schedule Control Systems Criteria was born out of a need for DOD program managers to better manage complex weapon system acquisitions. It has evolved over the last 20 years and has proved to be an effective DOD management tool. Although it is difficult, if not impossible, to quantify the benefits and costs of C/SCSC, we have sought to highlight cost drivers and offer recommendations to reduce their impact. The worth of C/SCSC to

DOD managers has been proved over the years. In all probability it will remain with us into the foreseeable future. Let's not question the worth of C/SCSC; let's seek to minimize its cost for the benefits we receive.

Cited References

1. J. Ronald Fox, Arming America. How the U.S. Buys Weapons (Cambridge, Mass.: Harvard University Press, 1974), p. 405.

2. Ibid.

3. Ibid.

4. Ibid., p. 406.

5. Ibid., p. 416.

6. R. Broodkorb, excerpts from briefing to HQ AFSC, April 1969.

7. Robert R. Kemps, presentation on the Cost Schedule Control Systems Criteria. OASD (Comptroller), February 1978, p. 9.

8. Ibid.

9. Final Report, Defense Industry 15-Man Ad Hoc Committee for the Application of C SCSC to Production, June 9, 1978; and Richard T. Estes and Marios A. Ostdiek, "Cost Schedule Control Systems Criteria: An Analysis of Managerial Utility," AFIT master's thesis, August 1975, pp. 72-74.

10. DOD Instruction 7000.2, "Performance Measurement for Selected Acquisitions," June 10, 1977, Enclosure 1, p. 5.

11. Ibid.

12. Ibid., p. 6.

13. Ibid., p. 7.

14. Ibid., p. 8.

15. Leonard S. Marrella, "The Effect of the Cost Schedule Control Systems Criteria (C SCSC) on Contractor Planning and Control," DSMC Individual Study Report, February 1973, pp. 163-165.

OMB Issues Proposed Revisions to A-76

In the *Federal Register* on January 12, 1983, OMB issued the Administration's proposed revision to Circular A-76, "Policies for Acquiring Commercial or Industrial Type Products and Services Needed by the Government." The circular applies to commercial activities which can be performed by either the government or the private sector. It requires agency heads to determine, through a cost comparison study, the most economical and effective way for the government to obtain a needed commercial product or service.

The 1979 version of the circular contained the first standardized cost comparison procedure. During the 3 years following its issuance, agencies' operating experiences indicated a need for various refinements and simplications. Accordingly, OMB initiated a comprehensive re-examination of the comparison methodology and other requirements. The major revisions to the circular proposed and published in the *Federal Register* are as follows:

—The cost study threshold is changed from a monetary one to a staffing one. The current circular provides that smaller activities with annual costs of $100,000 or less can be converted to contract without conducting a cost comparison study. OMB has proposed that the threshold be 10 or less full-time equivalents.

—The cost study waivers are revised to allow agency heads to exercise prudent management judgment in contracting out when activities with annual costs over $100,000 show that government activity would not be less costly than the private sector.

—The agency appeals process is strengthened and clarified to ensure that affected parties receive adequate documentation supporting the cost comparison decision.

—Several technical refinements are made to simplify cost comparison procedures and to reduce the time and cost of conducting a cost comparison study.

—Several clarifications of misconceptions about the A-76 program are included in the proposed revision.

YANKEE-class SSBN
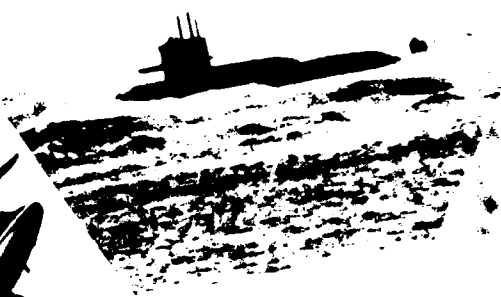
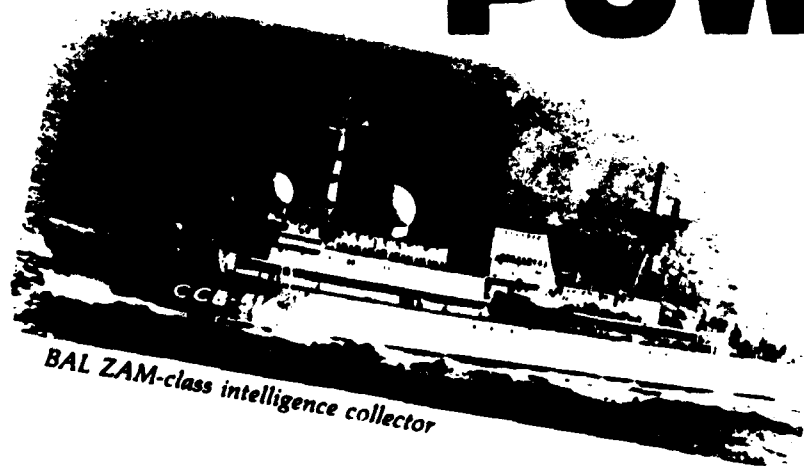Il-76/CANDID long-range jet transport

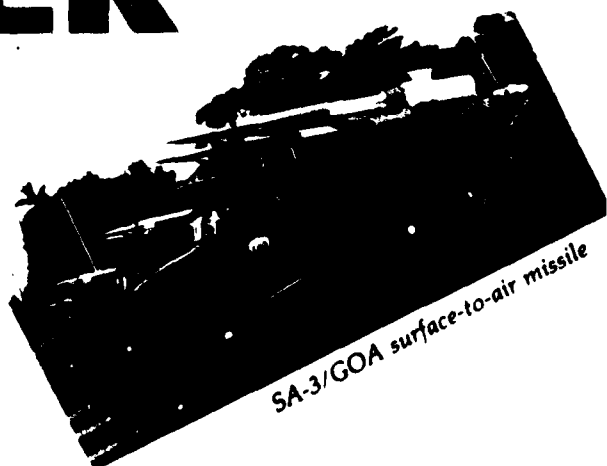Mi-26/HALO A heavy-lift helicopter

SOVIET MILITARY POWER

BAL ZAM-class intelligence collector
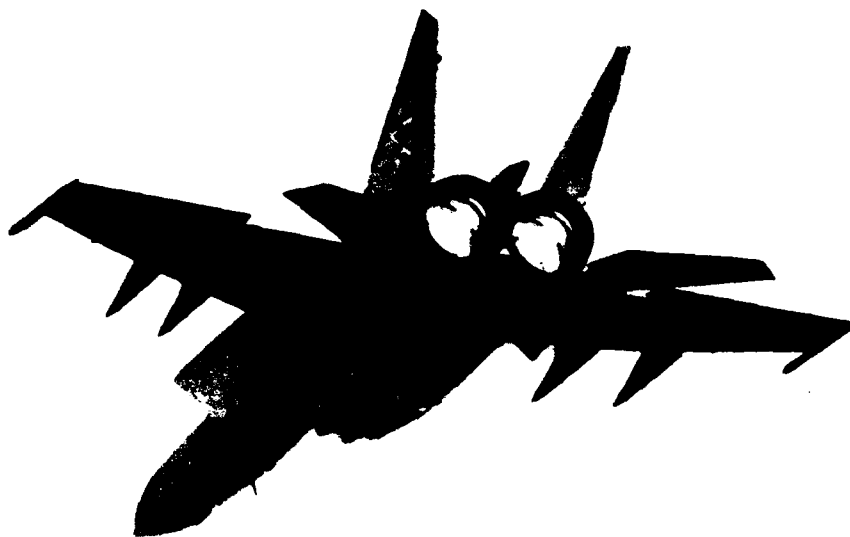
SA-3/GOA surface-to-air missile

In March 1983 Secretary of Defense Caspar W. Weinberger presented a comprehensive summary of current trends in the continuing Soviet military buildup. He also compared Soviet military strength with that of the United States and its NATO allies. The following is a condensation of his remarks, which were based on the recently released 1983 report entitled Soviet Military Power published by the Department of Defense.

Since late 1981 the Soviets have been testing and deploying new models in almost every class of nuclear weapon systems. In particular, despite the fact that their intercontinental forces are largely the product of the mid- to late 1970s, they are now in the process of developing follow-on systems to augment their already large and powerful intercontinental ballistic missile (ICBM) and submarine-launched ballistic missile (SLBM) forces. They are also devoting a great deal of effort to building a modern bomber force.

MiG-25/FOXBAT E interceptor

Looking at the Soviet Strategic Triad, we see:

—The Soviets have begun test flights of new land-based intercontinental ballistic missiles, ev..i as they continue to modernize their already deployed SS-17, SS-18, and SS-19 ICBM forces. All of these Soviet ICBMs are larger, more modern, and more powerful than any ICBMs we have deployed. The most recent versions of the SS-18 and SS-19 are more accurate as well, and possess the capability to destroy a large percentage of our own Minuteman ICBMs in their silos, while still providing a substantial, and largely invulnerable, reserve of several thousand ICBM warheads.

ICBM LAUNCHER AND REENTRY VEHICLE (RV) DEPLOYMENT

1968-1983

Soviet RVs

US RVs

Soviet ICBMs

US ICBMs

US ICBMs

	TITAN II	MINUTEMAN II	MINUTEMAN III	MX
NUMBER DEPLOYED	49	450	550	Development
WARHEADS	1	1	1	Up to 10
MAX RANGE (KM)	12 000	12 500	14 000	14 000
LAUNCH MODE	Hot	Hot		

USSR Nuclear Ballistic Missile Submarines and Missiles

US Nuclear Ballistic Missile Submarines and Missiles

ALFA-class attack submarine can exceed 40 knots submerged.

—To help put the Soviet ICBM development in perspective: The Soviets have deployed more highly accurate MX-like ICBM warheads in each of the past 3 years than are contained in our entire MX program.

—Over the past 2 years the Soviets have undertaken a major modernization of their submarine-launched ballistic missile force. The first Soviet TYPHOON-class submarine has completed its sea trials, and the second has been launched. Each TYPHOON-class submarine carries 20 missiles with multiple warheads, and has a range of over 8,000 kilometers, which means it can fire from the security of Soviet home waters and hit targets in North America, Europe, and Asia. The Soviets' older submarines with their shorter-range missiles had to make lengthy journeys to come within range of targets in North America. The TYPHOON submarine is larger than our own Trident submarine, and while the TYPHOON's SS-N 20 is about to be deployed, our Trident II missile will not be ready until 1989.

—The Soviet Union has begun test flights of a new strategic manned bomber—the BLACKJACK. This plane is 25 percent larger than the U.S. B-1.

The Soviets are also continuing annually to produce 30 BACKFIRE bombers, which, with refueling, can reach targets in the United States. With
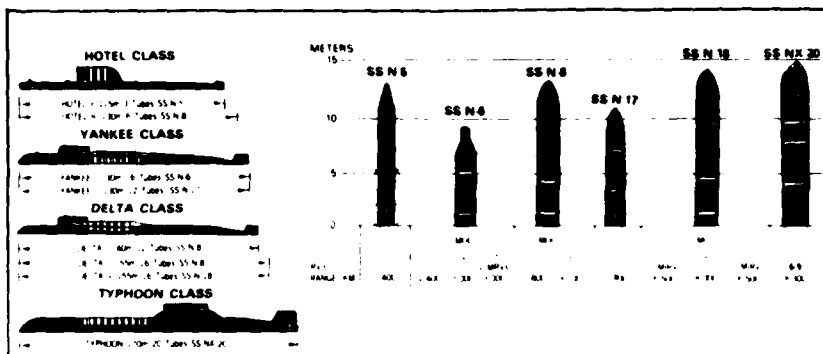
USSR KONI-class frigate in Cuban Navy.

USSR and US Long-Range Strike Aircraft
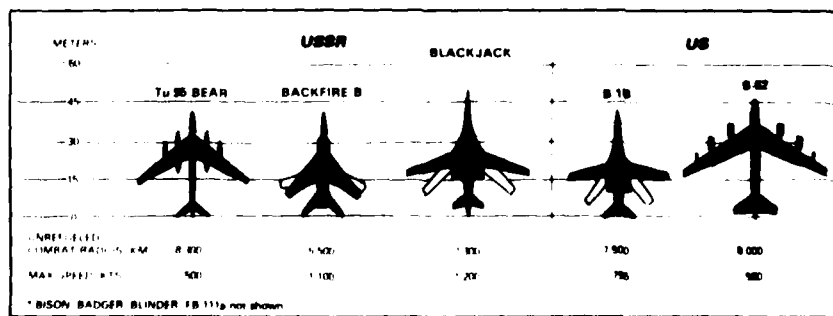
SS-21 transporter-erector-launcher

T-80 main battle tank

the deployment of the BACKFIRE and the development of the BLACKJACK, the Soviets are dramatically reducing the age of their bomber force and enhancing its ability to penetrate weak U.S. air defenses. This is particularly the case since they are building an air-launched cruise missile which both of these aircraft—and probably the older BEAR bombers as well—can carry.

—The Soviets have also continued to improve their strategic defenses, which are already the largest and most complex in the world. Currently they are upgrading the Moscow Anti-Ballistic Missile (ABM) system and building an enormous new radar system. The United States has no operational ABM system.

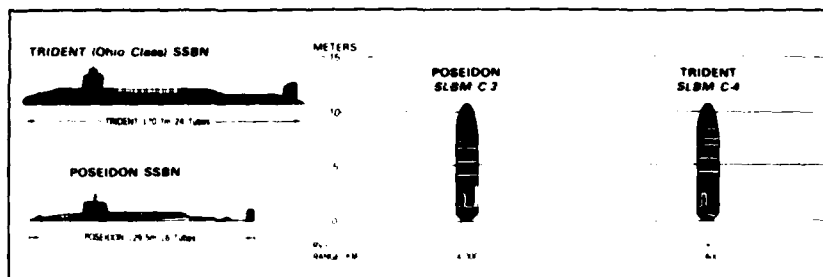What we see from these strategic force developments is that the Soviets have dramatically increased their *offensive* strategic capabilities. In particular the number, the explosive power, and the accuracy of their ICBMs are far greater than would be needed simply to deter attack. At the same time, the hardening of their ICBM silos, their provisions for reloading some of their larger ICBMs, and their enhanced strategic defenses, together with Soviet writings and exercises suggest that the Soviets are developing the capability to fight a prolonged nuclear war.

Improvements in Soviet strategic forces demonstrate the vital importance of our own strategic modernization program. Without the MX missile, the Trident submarine, and the B-1 bomber, we will be accepting permanent nuclear inferiority, and undermining the credibility of our nuclear deterrent. Our nuclear programs are designed to modernize and replace existing nuclear forces. We are not simply adding weapon upon weapon. We have fewer weapons and less explosive power today than we did 15 years ago. We are satisfied with this position so long as we have a program in place to remain the margin of safety.

However, Soviet theater forces are also being substantially modernized to enhance Soviet offensive capabilities. The Soviet Union is modernizing and deploying intermediate nuclear forces (INF) at an unparalleled pace. The Soviets have more than doubled the number of longer-range INF missile warheads since 1978—to over 1,200. Since 1981 the number of SS-20 longer-range intermediate nuclear launchers has grown from 250 to more than 330. These mobile launchers, each capable

of delivering three independently targeted nuclear warheads, are arrayed against Western Europe, the Middle East, parts of Africa, and most of Asia including China, Japan, Korea, and the Philippines. The United States and NATO have *no* comparable systems at this time.

It is this category of land-based nuclear missiles that President Reagan has proposed we eliminate entirely. If the Soviets agree to destroy their SS-20s and their older SS-4 and SS-5 missiles, NATO will not deploy its Pershing II and ground-launched cruise missiles (GLCM).

Our preferred objective is arms reduction, not arms buildup. We are pursuing defense modernization on a contingency basis. The Soviets should know we will meet any challenge they present, but that we would prefer to have them join with us in an effort to reduce the number of weapons.

Warsaw Pact Forces in Europe continue to outnumber NATO forces in manpower and in almost every category of weapons. For example, the Warsaw Pact has three times as many tanks in Europe as NATO. In 1981 we showed an artist's conception of the new Soviet main battle tank, the T-80, and stated that it was in "experimental production." This year, we estimate that the Soviets have produced 1,900 T-80 tanks, and have begun putting them in the field. The T-80 tank has increased armor protection and also increased protection against nuclear, biological, and chemical warfare. Improvements in Soviet tank forces indicate the crucial need for moving forward with the M-1 tank, the only NATO tank which can match the T-80.

Longer-Range Intermediate-Range Nuclear Forces

USSR Air Defense Interceptor Aircraft

METERS	MiG 25 FOXBAT A/E	Su 15 FLAGON E/F	Tu 128 FIDDLER B	Yak 28 FIREBAR	MiG 23 FLOGGER B/G	MiG FOXHOUND
SPEED KTS	1625	1200	950	18	1360	1375
RADIUS KM	460	1000	1250	40	1300	1500
ARMAMENT	4 AAMs	2 AAMs	4 AAMs	2 AAMs	6 AAMs	8 AAMs
WINGSPAN M	14	9	18		8 swept	14
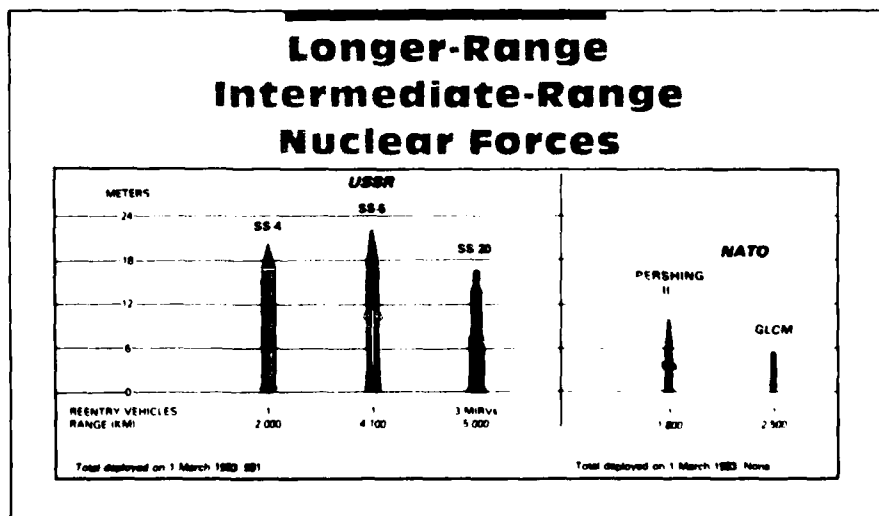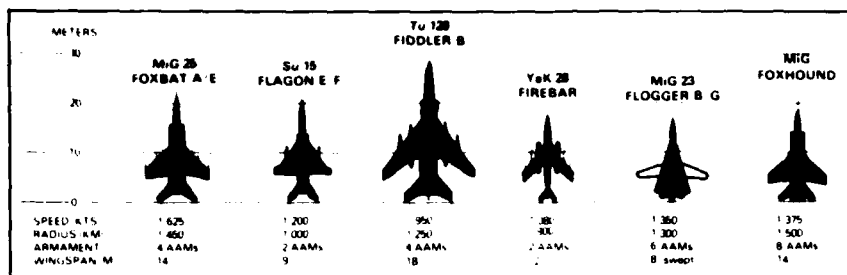
Warsaw Pact Forces in Europe also have been augmented by the deployment of the SS-21 mobile, short-range ballistic missile system and several new artillery pieces. Some of these are capable of firing nuclear warheads. In addition, the SU-24 FENCER ground attack aircraft has been forward deployed to Eastern Europe and to border bases in Asia. The nuclear-capable FENCER can operate in bad weather and can fly low to penetrate air defenses, which greatly increases Soviet capability to carry out deep strikes into NATO territory with little advance warning. Soviet ground attack aircraft can strike farther today than just 5 years ago, pointing up the need for modernizing our surface-to-air missile defense with *Patriot* and also our combat fighter force with F-15s and F-16s.

Looking at naval developments, we see that five Soviet shipyards have continued to produce new attack submarines for the world's largest submarine force. The first OSCAR-class cruise missile attack submarine has been photographed on sea trials. And a second OSCAR-class submarine has been launched. These submarines significantly increase the Soviets' ability to attack our own shipping on the high seas. Our request for an increased number of attack submarines reflects

Mi-24/HIND E ground attack helicopter

the need to counter this growing Soviet threat.

In 1981 there were two Soviet KIEV-class aircraft carriers in operation. Now there are three KIEV-class carriers in operation. A fourth has been launched, and the Soviets are continuing development of a new, larger class of aircraft carriers.

The Soviets also have placed a high priority on space warfare. They now have an operational antisatellite vehicle, which poses a major threat to our own command, communications, control, and intelligence capabilities. In addition, we believe one of the goals of their intensive development programs is the deployment in the 1990s of a large manned space station which will permit the Soviet Union to maintain a permanent military presence in space.

The Soviets are not just developing an increasingly sophisticated offensive force. They also are extending the reach of their military power.

The most recent blatant example of expanding Soviet military power is the 1979 Soviet invasion of Afghanistan. The Soviet 40th Army currently has over 105,000 troops in Afghanistan, an increase of 25,000 to 30,000 since the immediate post-invasion period. The Soviets have also introduced new weapons and equipment into Afghanistan, and have employed lethal chemical agents in violation of international treaties to which the Soviets themselves are party.

I have touched only on the most important new developments of Soviet military power. Let me end, however, by talking briefly about our own defense.

The United States is a defensive power, just as NATO is a defensive alliance. We do not start fights. We do not seek to impose our will on other nations. Our aim is simply to preserve peace with freedom, an aim we pursue along two roads.

The first of these roads is deterrence. To deter war we must ensure that no adversaries will ever calculate they have more to gain than to lose from aggression. For this we need sufficient, and credible, military capabilities to counter the threats arrayed against us.

The second of these roads is arms control. President Reagan has put forward a comprehensive, indeed a radical, arms control proposal. We and our allies are not just seeking negotiations; we are seeking a significant negotiated reduction in the weapons that most threaten the very existence of mankind.

To achieve arms reduction, however, we must give the Soviets an incentive to restrain their own massive military buildup. We have tried unilateral restraint, and the Soviets did not follow our example. If the Soviets see that we will not let them succeed in their quest for military superiority, if we persevere in restoring America's neglected defenses, then we have a real hope that they will join us in accepting the significant, mutual arms reductions that remain our best hope for a lasting peace.

US Air Defense Interceptor Aircraft

METERS	F 106A DELTA DAGGER	F 4C PHANTOM II	F 15A C EAGLE
SPEED KTS	1150	1200	1450
RADIUS KM	925	825	1000
ARMAMENT	5 AAMs	8 AAMs	8 AAMs
WINGSPAN M	12	12	11

ARCTIC OCEAN

Greenland

US

Iceland

Norway

Canada

Denmark

NORTH
ATLANTIC
OCEAN

Ireland United
Kingdom

France

Italy

Mediterranean
(35-40 Ships. Average)

Andorra

Portugal Spain

United States

Morocco

PACIFIC
OCEAN

U.S.

Mexico
Caribbean
(1 Ship Average
2-3 Aperiodically)

The Bahamas

Dominican
Republic

Western
Sahara

Algeria

Mauritania

Mali

Niger

Guatemala
El Salvador
Nicaragua

Jamaica

St Lucia

Dominica

Cape Verde

Senegal

Gambia

Costa Rica

Panama

St Vincent and
the Grenadines

Barbados
Grenada

Trinidad and Tobago

Guinea
Bissau

Ivory
Coast

Ghana

Benin

Nigeria

Venezuela

Guyana
Suriname

Sierra
Leone
Liberia

Togo

Colombia

Sao Tome and Principe

Equatorial
Guinea

Ecuador

West Africa
(5-8 Ships. Average)

Brazil

Bolivia

SOVIET MILITARY PERSONNEL ABROAD

Paraguay

SOUTH
ATLANTIC
OCEAN

	(Est.)
Latin America (including Cuba)	4,700
Sub-Saharan Africa	3,600-4,000
Mideast and North Africa	8,000
Asia* (including Vietnam)	2,500
* Afghanistan	105,000

Chile

Uruguay

Soviet Arms Clients (1977-1982)

$1 billion or more

Argentina

$50 million - $1 billion

CUBAN MILITARY PERSONNEL ABROAD

Soviet Treaties of Friendship ★

Latin America	2,000
Sub-Saharan Africa	35,000-40,000
Mideast and North Africa	300
Asia	100

Soviet Military Personnel Abroad ↓

Mutual Defense Treaties ●

POWER PROJECTION

ARCTIC OCEAN

Finland

Sweden

Soviet Union

Poland
Czech
Aus. Hung.
Yugo. Roman.a
Bulgaria
Alb.

Mongolia

N. Korea
S. Korea

China

Japan

Turkey

Iran

Afghanistan

Pakistan

Nepal Bhutan

Libya

Egypt

Saudi Arabia

UAE

Oman

India

Bangladesh

Burma

Hong Kong (U.K.)
Macan (Port.)

PACIFIC OCEAN

Chad

Sudan

C A R

Cameroon

Zaire

Uganda

Kenya

Tanzania

Somalia

Sri Lanka

INDIAN OCEAN

Indian Ocean
(26 Ships, Average)

Thailand

Kampuchea

South China Sea
(15 Ships, Average)
Philippines

Malaysia
Singapore

Seychelles

Comoros

Indonesia

Papua
New Guinea

Solomon
Islands

Nauru

Kiribati

Tuvalu

Zambia

Zimbabwe

Malawi

Madagascar

Mauritius

Western
Samoa

Fiji

Tonga

Botswana

Mozambique

Swaziland

Australia

South Africa

Lesotho

New Zealand

Major Cuban Presence ....

Major Soviet Naval Operating Areas ....

Deployed Soviet Naval Forces ....

Nuclear Submarine Operating Areas ....

Soviet Naval Access ....

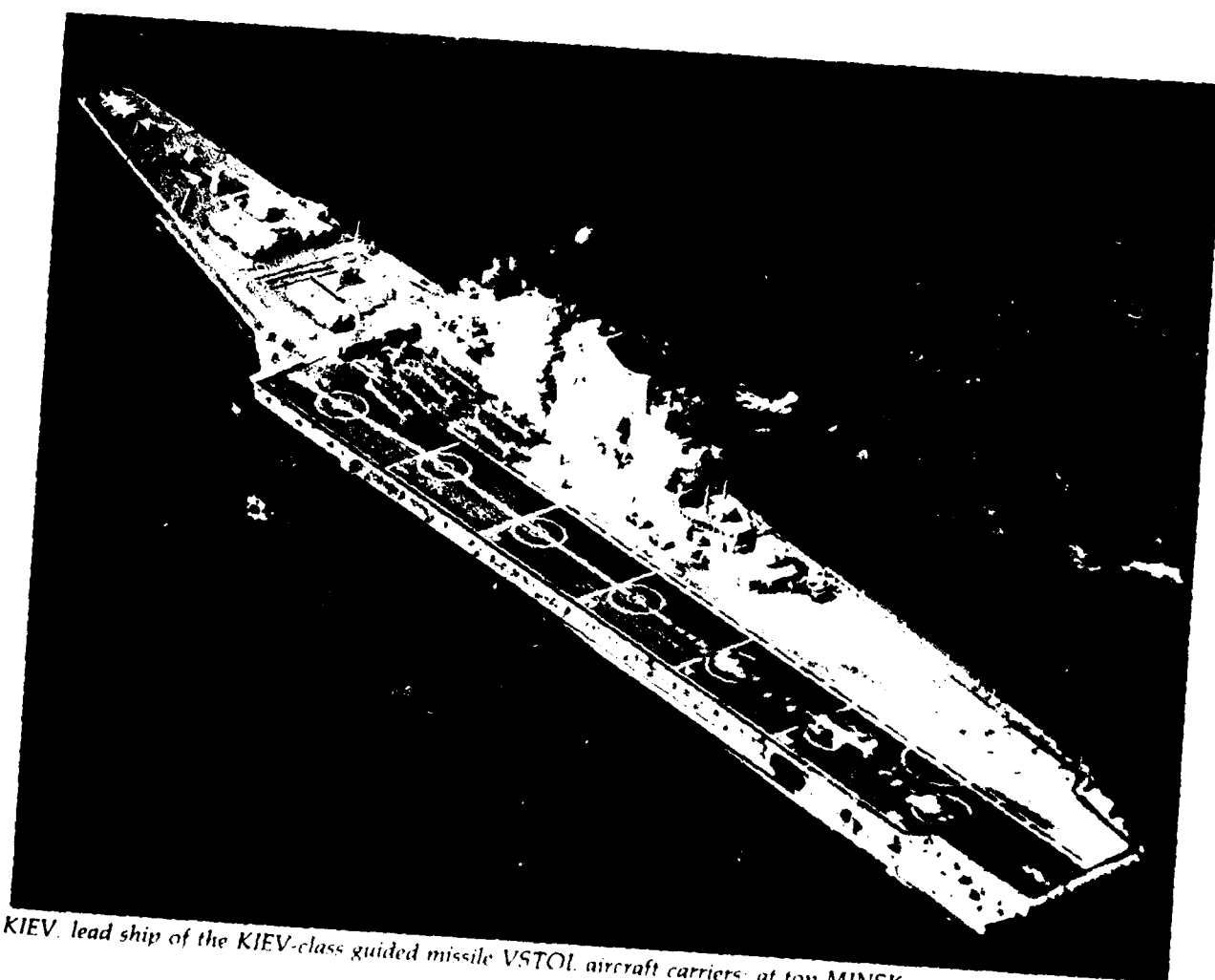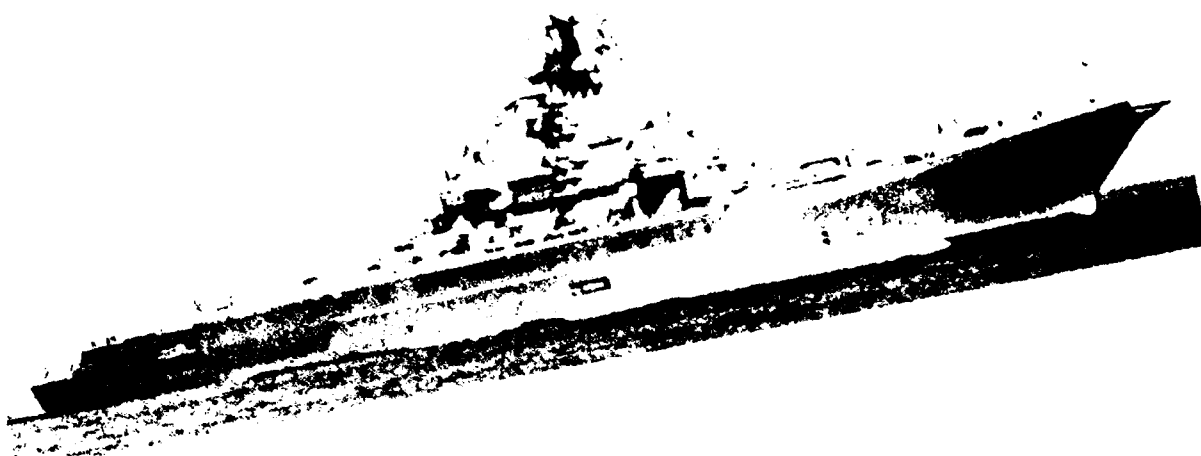**Airfield Access for Reconnaissance Deployments** ......

KIEV, lead ship of the KIEV-class guided missile VSTOL aircraft carriers; at top MINSK.

Legal Characteristics and Cost Uncertainties Associated with

CONTRACT "TYPES"

Charles J. Gaisor

Government contracts are divided into specific types of compensation arrangements reflecting the government's varying responsibility as the buyer to pay the allowable costs incurred by the contractor, the seller. At one end of the responsibility spectrum is the firm-fixed-price contract that does not allow for any subsequent price adjustment regardless of the actual costs incurred by the contractor. At the other end is the cost-plus-fixed-fee contract, where profit, rather than price, is fixed, and the government pays the contractor's actual allowable costs, at whatever funded level, as long as the contract is in effect.[1]

Much has been written about government contractual promises of consideration in return for contracted work, but little has been done to clarify the nature of the contractor's concomitant legal promises to accomplish that work. These contractor promises will be treated here as two interrelated fundamentals—contract forms (completion and term) and contract family groups (cost reimbursement and fixed price).

A third concept has limited treatment in government contracting literature: that is the problem of accommodating contract cost uncertainty, based on the range of probable cost outcomes generated by technical uncertainty, as a first step toward sound structuring of incentive provisions. This paper deals with each of these three problem areas.

Contract Forms

The *form* of a contract is either "completion" or "term." This

represents an important dimension of a contractor's legal promise to accomplish something in return for monetary consideration. It is the form of the contract that reflects the contractor's legal obligation, or lack of obligation, to deliver end products as identified in a statement of work or in a detailed specification.

A term contract specifies how much work is to be done – not what is to be technically accomplished.

Completion Contracts

Completion form contracts, in addition to being either cost-reimbursement or fixed-price, are used when the contractor is required, as promised, to deliver a definitive end product. A description of the end product is contained in the contract "schedule" and constitutes the general scope of the contract. Upon delivery and formal acceptance by the government of the specified end products, the contract is considered "complete": its scope has been met and final payment can be made.

Consider two different situations in which the work under a contract is *not* completed. First, if the work as specified is under a cost-reimbursement contract and is not completed by the contractor within the estimated cost, he is, nonetheless, obligated to continue to work under the contract as long as the government is willing to fund the over-

run. Second, under a fixed-price completion contract as contrasted to a cost-reimbursement contract, any additional funding requirement beyond the fixed (or ceiling) price rests entirely on the contractor.

Term Contracts

Term contracts which are generally restricted to cost-plus-fixed-fee, cost-plus-award-fee, and firm-fixed-price types, are customarily referred to as level-of-effort (LOE) contracts. They are often used for early research or development work where technical outcomes are difficult, if not impossible, to predict, and assurance of technical success is lacking. (See Defense Acquisition Regulation (DAR) 1-305.5). The parties to a term contract agree, therefore, that the deliverable end product, constituting the scope of the contract and the contractor's legal promise, shall be simply person-days (or months, or years) of effort over a designated period of time, as specified contractually, and using specified personnel skill levels and facilities.[1]

When the specified level of effort is "delivered," the contract is legally complete; its scope is fulfilled, and final payment is made *irrespective of what was actually accomplished technically* by the contractor's person-days of effort. Accordingly, an important inference can be drawn from a term-contract environment, in contrast with that of the aforementioned completion contract. For example: If, after the contractor has delivered the specified hours of effort under a term contract, the government can properly justify continued work on the task—and volunteers additional funding—the con-

Mr. Gaisor is a Professor of Industrial Management in DSMC's Business Management Department

tractor is not legally bound, unlike the situation in a completion contract, to comply. His refusal to continue work is entirely legitimate because he did, in fact, satisfy all contractual requirements when he delivered the specified person-days.

Under term contracts, then, the government bears the legal risk, remote as it is, that the contractor may not wish to continue the work, even when it is in the best interest of the government that he do so. Under completion contracts, however, the government bears no such risk because the contractor must continue to work (unless he wishes to breach) until the contract is deemed "completed." For this reason, it is a matter of DAR policy that, postulating clearly defined tasks and end products, the government prefers completion contracts to term contracts. (See DAR 3-405.6(d).)

It is my opinion, given the acquisition circumstances suitable for using a term contract, that a firm-fixed-price or firm-fixed—price award-fee contract is generally preferable to any cost-type contract. With a term contract, the government is buying a specified number of hours—a knowable outcome. A term contract "transforms" high-technical uncertainty and its associated high-cost risk—which, had the contract been a completion form, would have been best dealt with using a cost-type contract—into the certainty of a specified number of hours to be spent. It is patently absurd to write cost-reimbursement contracts (i.e. low-cost risk) for specified work whose outcomes are totally lacking in technical uncertainty.

Despite this contractual transformation of high risk into non-risk, there still exists a degree of uncertainty and corresponding cost risk in any term contract; however, this kind of risk is associated with relatively routine business practices such as forecasting labor wage rates and overhead rates. Errors in these forecasts have little or nothing to do with the technical uncertainty and corresponding cost risk in a particular contract. Consequently, it is only the fixed-price term contract that can hold the contractor fully accountable, as he should be, for routine business forecasting errors. Put another way, the only way a cost-type *term* contract can overrun is by an increase in a contractor's actual rate outcomes beyond those used in establishing the initial

contract cost estimate. Make no mistake, it is *legally impossible to overrun* the number of hours, i.e., scope, contracted for. (See DAR 3.404.7 "Firm Fixed Price Level of Effort Term Contract.")

Contract Family Groups

The second fundamental is contract family groups. They are divided into the cost-reimbursement family and the fixed-price family, reflecting the contractor's legal obligation to "try," or to "guarantee," respectively, to accomplish the work specified in the contract.[1]

Fixed-price completion contracts should be used only in cases where there are no substantial uncertainties in cost, performance, or schedule outcomes.

Cost-Reimbursement Group

In cost-reimbursement contracts the government is required to reimburse all costs authorized by the contracting officer as allowable, allocable, and reasonable. Thus, without any new consideration from the contractor, the procuring agency can provide overrun monies in the form of additional funding to help the contractor meet his contractual obligations for end product performances and schedule. (See DAR 7-203.5 "Inspection of Supplies and Correction of Defects," 7-402.5 "Inspection and Correction of Defects (R&D)," and 17-1909.5 "Inspection of Services Clauses.) As indicated earlier, his contractual obligation is a promise to "try," as distinct from a "guarantee," to fulfill the requirements of the contract.

Both completion and term cost-reimbursement contracts allow the government flexibility in redirecting the contractor's efforts, within the scope of the contract, in response to changes in technology or mission requirements. A broadly worded statement of work is especially helpful. Note, however, that the flexibility thus accorded the government is not accomplished without

commensurate additional cost, while the contractor leaves no stone unturned as he continues to "try."

Fixed-Price Group

The major characteristic that distinguishes fixed-price from cost-reimbursement contracts is that with fixed-price contracts, funding of cost overruns (but not including a class of cost growth caused by either in-scope and out-of-scope changes) beyond a firm-fixed price (or ceiling price) is legally impossible, because the contractor is obligated to deliver a specified end product at the contractual price, regardless of the actual cost. (See DAR 7-103.5 "Inspection" [of supplies], 7-302.4 "Inspection" [of R&D], and 7-1902.4 "Inspection" [of services]). On the other hand, if the contractor's actual costs are significantly lower than the estimates used to establish the agreed-on price he pockets all, or part of the savings. While this places a strong incentive for cost control on the contractor, the government, in certain situations, may be less interested in cost control than in ensuring adequate performance or on-time delivery of a critical system—even with a cost overrun. The government also may not be particularly interested in penalizing the contractor for experiencing technical difficulties that were unforeseen by both parties. For these reasons, fixed-price completion contracts should be used only for acquisitions that do not involve substantial uncertainties in cost, end-product performance, or schedule outcomes.

Cost Uncertainties in Incentive Contracts

The third fundamental is the problem of establishing a range of probable cost outcomes in an incentive contract. To be operationally effective, the following underlying cost assumptions guiding an incentive contract structuring plan must be met:

—That the *cost outcomes* of the acquisition *are uncertain* at the outset of the effort;
—That the contractor *can control at least partially, the cost outcome* of the effort;
—That the contractor *will control cost* to the extent possible in an attempt to maximize fee (or profit) on the contract.

With these assumptions in mind, recognize that all incentive contracts provide for a range of subjectively deter-

mined probable cost outcomes (from underruns to overruns) in the incentive structure. Because the contractor is encouraged by the incentive provisions of the contract to reduce cost outcomes from the upper limit within this range, all outcomes within the range must be achievable by him. Determination of the cost range—called the range of incentive effectiveness (RIE)—in the contract is an essential first step in structuring the contract.

Three points (sometimes referred to as a three-point estimate) should be specified that reflect the probability distribution of uncertain cost outcomes: (1) a target outcome, (2) an outcome with a low chance of being exceeded (the "largest" overrun), and (3) an outcome with a high chance of being exceeded (the "largest" underrun). These three points describe the entire cost RIE.

In structuring an incentive provision, it makes little difference which measure of central tendency of the uncertain outcomes for cost is chosen as the target. However, experience indicates that the medium (or 50/50) point of the distribution is the most reliable and easiest to use. A judgment need only be made that, from the data and experience available there appears to be an equal chance that the actual outcome will be greater, or less, than the target outcome.

The choice of a target and an RIE (the entire three-point estimate) is a matter of judgment by the program personnel. While all reasonable efforts must be made to document the choice of the target and the RIE through such avenues as a detailed examination of the contractor's proposal, comparison with similar systems, and the use of mathematical techniques of parametric cost estimating, it is inevitable that uncertainties will remain and that mature negotiating skill will be required to arrive at the appropriate target and the RIE.

Bear in mind that if the contract effort is judged to have little technical uncertainty (resulting in a "narrow" range of probable cost outcomes), it may be inappropriate to introduce a cost-incentive provision in the first instance. In this case, consider using a firm-fixed-price contract. At the other extreme, if there is a broad range of probable cost outcomes (indicative of severe state-of-the-art problems in meeting performance outcomes, or if

outcomes are not measureable), use a straight cost-plus-fixed-fee or cost-plus-award-fee contract.

Summary

In summary, there are three fundamental considerations that have an impact on government contracts. The first two—contract forms and family groups—are essentially legal, yet thoroughly compelling, formats. Contract forms are either term or completion and represent legal deliverables, therefore scope, of the work to be performed. The deliverable of a term contract is represented by a specified number of units of time by skill level to be spent on tasks. The deliverable of a completion contract consists of a coherent description of a completed product or service.

The second fundamental concerns contract family groups—the fixed-price and cost-reimbursement classes. As is true with contract forms, contract family groups are primarily legal concepts: but the family groups represent two extremes of contractual promises by the seller: in fixed-price contracts the seller promises, unequivocally, to deliver a product to the specification, on time, and at the price (or the price formula). By contrast, in a cost-reimbursement contract the seller promises to try, that is, to use his best effort, to deliver a product to the specification, on time, and within the estimated (or target) cost.

The third fundamental is the importance to the program office of determining the variation from the target cost of probable cost outcomes generated by technical uncertainty. Identifying the range of the variation, in addition to the point of central tendency representing the target cost, must be done to rational points for the upper and lower limits of the total range of outcomes. A properly structured incentive provision, therefore, must be based on this range of incentive effectiveness as a first step in producing a sound contract.

It is important to understand that successful incentive contract structuring, like all planning, is not dependent upon exact predictions of cost and performance. Accordingly, when exact predictions of the future (which are beyond human capability and therefore impossible to achieve) are considered necessary and equivalent to sound incentive contracting, managers must conclude that this kind of contracting

is also impossible and thus does not warrant concerted effort. Indeed, the resulting contractual incentive provisions may be more ceremonial than they are compelling. Consequently, an effective contract structure is not dependent upon fastidious predictions: it is precisely when outcomes are uncertain that sound incentive structuring becomes critical as a plausible alternative to less rigorous contracting methods.

Notes

1 The customary use of the words profit and fee makes a distinction between these two terms: cost-reimbursement contracts involve a fee whereas fixed price contracts involve a profit. Although the difference is primarily semantic, this distinction is made by government contracting professionals.

2 The word overrun applies to the narrow circumstances where actual contract cost for a product or service under the then current specification is greater than the then current target or estimated cost. Importantly, overruns are never fee-bearing, unlike other modifications (both within and out-of-scope to a contract which are fee-bearing.

3 To comply, at least in part with the prohibition against contracting for personal services, a term contract must identify, if not describe, the physical end-products anticipated to materialize from the level of effort contracted for.

4 Each of the two contract family groups is further divided into a number of specific contract types. It is not the purpose of this paper to discuss details of the various types of compensation arrangements that can be used, since that information is treated elsewhere.

DARCOM Combines Commands

COM, and NLABS is located at Natick, Mass. Elements of ARRADCOM are located at Dover, N.J., Aberdeen Proving Ground, Md., and Watervliet, N.Y. ARRCOM is at Rock Island, Ill.

The newly designated AVSCOM and TROSCOM will be headquartered in St. Louis, while home for AMCCOM will be Rock Island. AVSCOM will serve as a single manager for research, development, acquisition, and support of Army aviation systems, and TROSCOM will perform the same role for Army troop support equipment. The role for AMCCOM will be total management for armament, ammunition, and chemical materiel logistics and readiness support.

ARRIUS' THREE LAWS

An Essay on Human Resources Management

Lieutenant Colonel B. H. Fortiwon

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"**W**ork longer hours." That's what the general said. And that was not all he said.

In one of my previous assignments, I worked in a medium-sized organization headed by General Quintus Arrius. General Arrius was a bright, energetic young general officer whom some might describe as a workaholic. He typically worked an 11-hour day, took 1 to 2 hours of work home with him every evening (and did it!), and frequently came into work for 2 to 3 hours at least once, sometimes twice, during a weekend.

General Arrius has an insatiable appetite for information, wanting to know the minute details of all that was going on in the organization. He accomplished this by a variety of mechanisms: weekly reports from the heads of his eight subordinate organizations (sometimes as many as 15 projects/subordinate organizations) bimonthly reports on the special programs for which the organization produced annual reports (over 30 such annual reports); memos, which contained questions he had on past, present, and potential activities and projects; requests for in-depth looks at unexplored areas; and direction of one sort or another (60 to 130 of these went out per month and generally required a response within three weeks).

General Arrius believed everything could and should be done *now*. He was constantly looking for those who could perform in this manner. He wanted his organization to do as much as possible. Beneath all this, but sometimes obscured by the frenetic pace, was a sincere desire on his part to have his organization be effective and make significant contributions as an agency involved in the natic defense arena.

In the course of my assignment in which I worked closely with General Arrius for an extended period, I noted that his management predilections were often articulated in the same manner in particular situations. So consistent were his responses to these situations that I formulated what became known between us as "Arrius' Three Laws":

Arrius' 1st Law: Work longer hours.
Arrius' 2nd Law: Make people uncomfortable.
Arrius' 3rd Law: Don't trust anybody (except your mother, but check on her occasionally).

Arrius' 1st Law was the general's typical response when anyone expressed the opinion that a task he wanted done could not be accomplished in the time designated. If I told him a particular subordinate organiza-

tion was busy with two or three other priority tasks, he would merely say, "That's easy, just work longer hours," or "What about the weekend?"
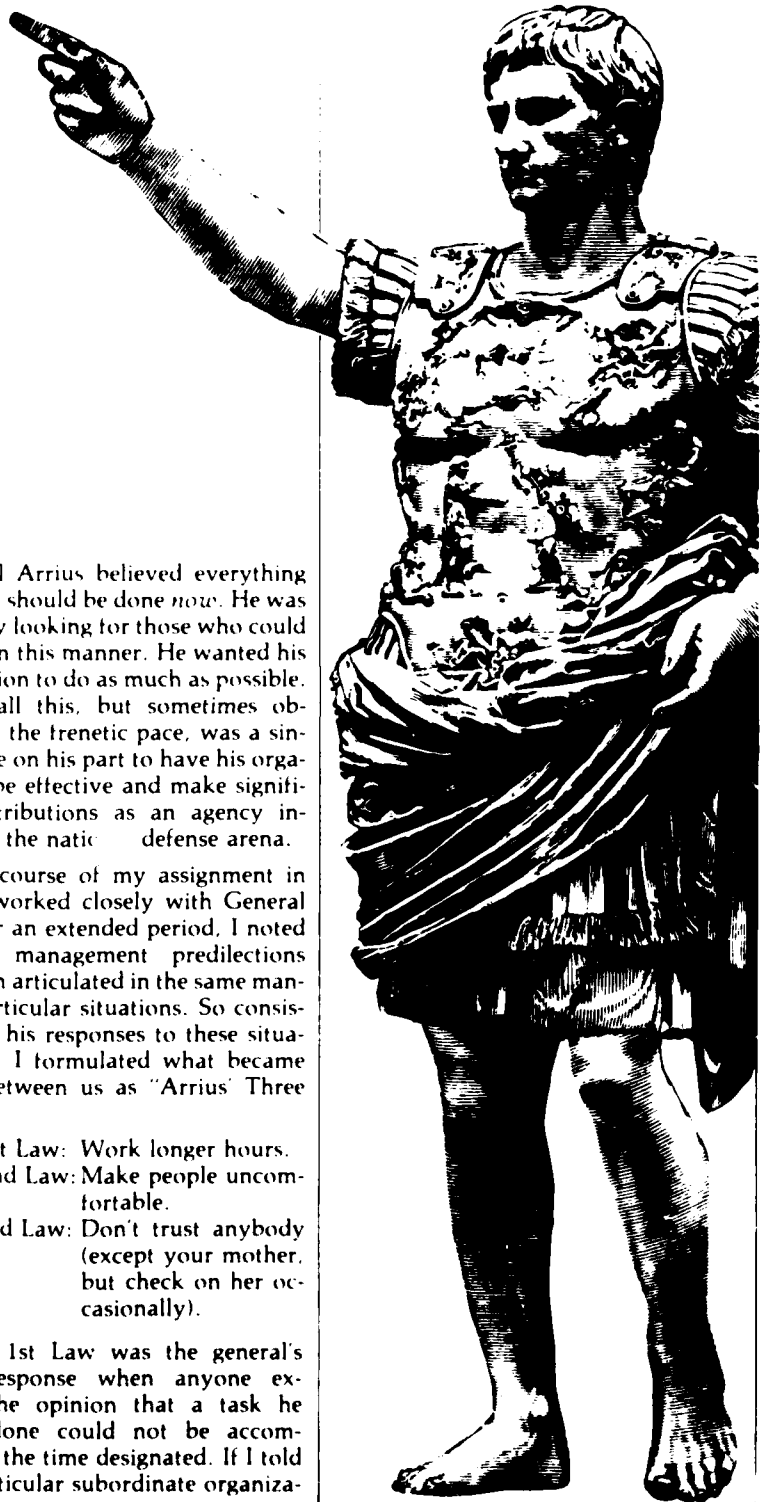
Arrius' 2nd Law was his response when I once asked, "What is the most important thing you can do for an organization?" "Make them uncomfortable," he said. "When people are comfortable, they think things are fine and all is going well. Usually, things aren't fine, and people aren't working to their potential. When people are uncomfortable, they are always trying to do a little better—and the organization is the benefactor."

This desire to make people uncomfortable was also expressed in an analogy General Arrius once shared with me. "People are like rubber bands," he said. "If you stretch them (read "make them uncomfortable") and hold them there for a while, they soon become relaxed (comfortable) and are bigger. So, you stretch them again; and, soon, they become relaxed again. As you continue to stretch them, they grow." Then he added, "Sometimes, they go 'Bang!' and you send them to the hospital."

Arrius' 3rd Law was expressed several times when I asked why he constantly checked on this or that task. He had learned from getting "burned" several times, he said, that you cannot trust anyone to do anything without checking on them. Knowing what an exemplary officer his deputy was, I asked if the general trusted him. "More or less," he responded, "more or less." Sometime later, I asked the general what I might do to move myself into a higher trust category than "more-or-less." He told me, "Don't worry about it; that's as high as anyone can get."

On the surface, these three laws appear to be very callous and would probably be classified as typical of McGregor's Theory X management. In light of the plethora of modern management theories that emphasize employee-centered approaches, these laws certainly seem to be outmoded. Working longer hours can lead to increased stress in, and often among, employees. Smart points out that continually working extended hours can lead to "burnout" and that managers should

not allow subordinates to continually work overtime or not take extended vacations.[1]

In his review on managerial stress, Topper noted that those under considerable stress are those who establish unreasonable suspenses and stress quantity (longer hours) over quality (better products)—and this stress is transmitted to those who work for these types of managers.[2] Consistently working longer hours can actually lead to reduced productivity. Kiev and Kohn postulated that certain amounts of stress can improve job performance, but that continuous, unabated increases in stress can cause performance to deteriorate as shown in Figure 1.[3] Making people "uncomfortable" is another potential stress inducer, one that can easily decrease performance as increase it. When people are uncomfortable, they may be over the peak of the curve (Figure 1) and, therefore, not performing optimally. Finally, not trusting employees and frequently checking on them may indicate a fundamental inability to trust and/or failure to exercise delegation to a useful degree. Workers who do not believe they are trusted can become demoralized and behave in a manner to fulfill the "untrustworthy" prophecy. They also can become frustrated and less productive.

As the previous discussion indicates, finding faults in Arrius' Three Laws is certainly easy enough. A cursory examination of them at their face value might lead anyone to similar conclusions. However, a better understanding can be achieved by looking behind

their over stated intent and in light of some of the current management philosophies.

After having thoughtfully examined Arrius' Three Laws, I have developed what I call "Fortiwon's Principles." These Principles put the Laws in a more participative context as opposed to an authoritarian one. I believe that, if the Principles are accepted by managers, they can serve to foster a motivated workforce and a more productive organization.

Fortiwon's 1st Principle is "Work smarter and more efficiently—longer only when absolutely necessary." Those who work longer are often only letting one of Parkinson's Law's Corollaries work against them: Work expands to fill the allotted time. We often find that when we limit ourselves to a given time interval for a task, we invariably get the work done without unacceptable decreases in quality. We can do the same with our workdays if we discipline ourselves to set limits on their length.

We are smart and use time more efficiently when we categorize the tasks we have to accomplish. High priority tasks are given an "A" designation; medium priority tasks, a "B"; and low priority tasks, a "C." Working the As first and diligently, followed with the Bs, is the smart and efficient way to work. Many Cs can wait—and often do not have to be done at all. Managers too often get in the habit of thinking every task deserves the same attention. The smart manager must carefully establish priorities for the in-

Figure 1. JOB PERFORMANCE AS A FUNCTION OF STRESS LEVEL (3)
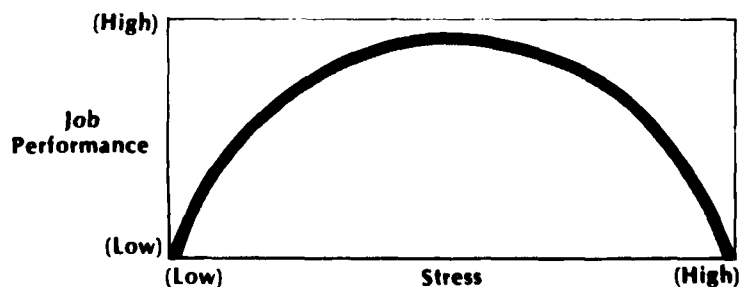
# "Don't trust anyone (except your mother, but check on her occasionally)."

formation read, used, requested, and disseminated. Task accomplishment is also measurably improved by effective delegation; this will be discussed under the 3rd Principle. All these efforts will reduce stress, both on the manager and the employees, and serve to improve the working climate in the organization.

Fortiwon's 2nd Principle is "Challenge people to be the best they can be." I believe people in a work environment can be identified on a continuum of "motivation states." These states are shown in Figure 2.

The effect that these states create in a job performance sense can be shown by superimposing the motivation continuum on the Kiev-Kohn diagram as shown in Figure 3. From this figure we see that challenging employees—perhaps even making them uncomfortable occasionally—keeps them at the peak of performance. By constantly making them uncomfortable, the manager risks pushing them closer to frustration with its attendant reduction in the job performance—and potentially to the burnout/breakdown stage.

The manager must determine for each employee just what individual motivations are. Mindell and Gorden offer some interesting insights into the values held by members of today's work force and the means to tap these values to motivate them.[4] Essentially, the manager must be an astute observer and take time with the employees. In so doing, the manager discovers what their motivations are and can improve their job performance by using these values to establish a climate of challenge for each individual in the organization. An essential point here is that such a values search is highly individual; what works for one employee

Figure 3. THE MOTIVATION CONTINUUM AND ITS INFLUENCE ON PRODUCTIVITY
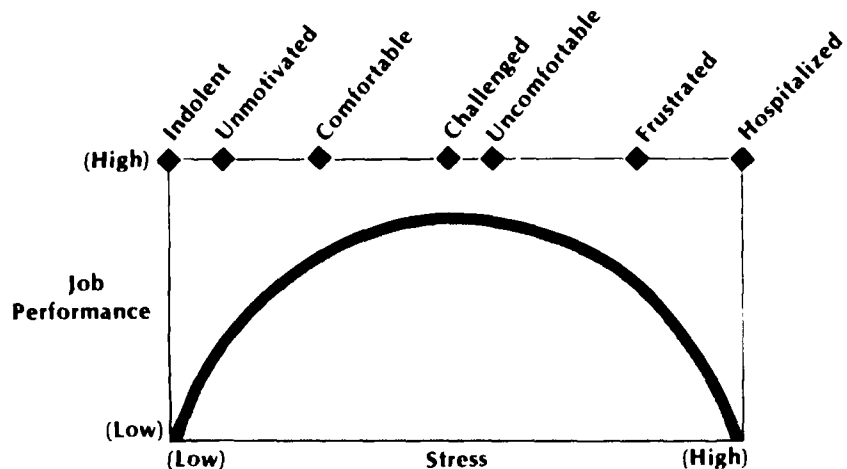
may not work for another. The manager's efforts in this regard take time, but the payoff will be a more motivated employee and a more productive organization.

Fortiwon's 3rd Principle is "Trust everybody until they indicate another approach is required—and follow through and follow up." Rotter has concluded that those who trust people find that most of those they trust behave in a manner to earn that trust.[5] Therefore, the manager's establishing a climate of trust in the organization is essential. The managers does this most effectively by learning and practicing the art of delegation.

Brown offers some useful guidelines for effective delegation.[6]

Fundamentaly, they involve making delegation an interactive process between the manager and the employee. The managers learns as much as possible about the employee's characteristics and capabilities, establishes goals and objectives for each employee with respect to what can be delegated, discusses them and establishes with the employee standards of performance, and then assesses the results and provides feedback.

This latter step is what I have termed the "follow through, follow up." It is not the constant "checking" on what the employee is doing or how it is being done—and certainly not making "nit-picking" changes in the employee's approach or products. With appropriate guidelines established, the manager "follows through" by delegating tasks (and not just the unpleasant ones or those Cs the manager doesn't want to do, by the way) to the employee and lets the employee work the tasks. Progress reports, which may give the manager some feeling of security, are appropriate, but only if they are established as requirements ahead of time and agreed upon. This prevents the appearance of "checking" when the manager wants to know the status.

"Follow up" encompasses two actions: control and feedback. Delegating does not mean giving a task to the employee and forgetting about it. The manager can take a vital interest in the effort by discussing it with the employee when occasions present themselves; for example, asking if the employee is

Figure 2. CONTINUUM OF MOTIVATION STATES OF EMPLOYEES
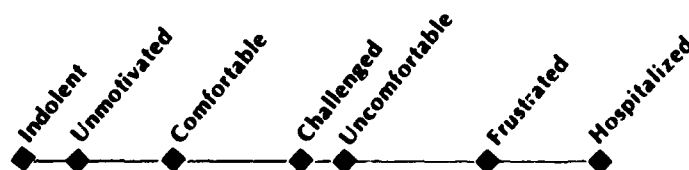
"**M**ake people uncomfortable."

getting the help from others or the information needed to complete the tasks or what the manager might do to help. Timely feedback is extremely important in management, and most employees want to receive it. Feedback provides them a gauge against which to measure their performance on a task completed and to improve performance on future ones. In a survey of employee motivation factors, Wasiniak noted that feelings of achievement from doing challenging work well ranks first among employees.

The actions discussed here in developing trust with and among employees, delegating challenging tasks to them, and providing them timely, useful feedback will help establish a climate within the organization which enhances employee motivation and job performance.

Comparing Arrius Laws and Fortiwon's Principles, one finds, essentially, little difference between them. Each strives to achieve a goal: a productive organization. The primary difference between them is one of tone, even style, perhaps. In managing an organization, however, one cannot discount tone or style because it can be the single determinant of the climate established between the manager and the employees.

You will note I have used the word "climate" several times in this paper. The management "climate" within an

organization, in terms of understanding the values and inner needs of employees, providing them challenging work, and in establishing trust is critical to job performance. In the final analysis, it is essential to the success of

the organization, the employees, and the manager. The *raison d'etre* of the manager in the business and government organization today is to provide that climate. You can choose to do it using Arrius Laws or Fortiwon's Principles. The choice is yours.

B. H. Fortiwon is a non de plume taken from the movie Ben-Hur based on General Lew Wallace's book Ben-Hur was number 41 on the Roman slave galley command by the tribune General Quintus Arrius. The events described in this article are based on fact

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DOD Awards Funds for Upgrading University Research Equipment

Under Secretary of Defense for Research and Engineering Dr. Richard D. DeLauer has announced 202 funding awards to 80 universities to upgrade research equipment. These are the first funding awards under a 5-year program designed to improve the capabilities of colleges and universities to perform research related to national defense.

Approximately 2,500 proposals were received following the announcement last fall of the Department of Defense (DOD) University Research Instrumentation Program. The Army Research Office, the Office of Naval Research, and the Air Force Office of Scientific

Research selected the winning proposals primarily on the basis of the potential contribution to the total DOD research effort and after thorough technical review. The awards represent an initial investment of $30 million for fiscal year 1983. The DOD plans to continue the program for 4 years at a cost of about $150 million.

The number of funded proposals is limited by the availability of funds. The 2,500 proposals represent requirements of more than $645 million, which indicates the need for new and upgraded research equipment in universities.

Responsibility for the program rotates among the three military services. The point of contact for the second solicitation will be the Air Force Office of Scientific Research. A brochure announcing the solicitation for fiscal year 1984 will be available this summer.

Additional information may be obtained by writing to:

DOD-University Instrumentation
  Program
Air Force Office of Scientific Research
AFOSR-PKO
Bolling Air Force Base
Washington, D.C. 20332

The Program Manager Authority Scenario

Major Frederick T. Dehner, USAF

In my 4½ years as a faculty member at the Defense Systems Management College, I have been privileged to hear presentations by more than 100 Department of Defense (DOD) and industry program managers. They all have been unequivocally clear concerning their responsibilities and accountability as program managers; however, I have witnessed a divergence of opinion concerning the *authority* of a program manager. It has run the gamut from "I have total authority over my program" to "I get more 'help' than I need" to "If the hierarchy would quit pulsating my program and just let me manage it, I could exercise my responsibility and perform in a better manner." Those students with program management experience have echoed these sentiments.

The Concept of Authority

I conclude from these observations that the concept of authority is not well understood. The clash of opinions on the subject appears to have generated confusion about the nature of authority. This confusion can hinder a program manager's ability to accomplish the primary objectives of the defense acquisition process, i.e., the enhanced readiness and sustainability of our operational forces.

I researched the leading management textbooks and found little that could be used to formulate, in a practical manner, an operational understanding of real project authority. So I set out to identify and integrate my own perception of the various aspects of program manager authority. Allow me to share the results of my efforts with you.

* Whenever in this article "man," "men," or their related pronouns appear, either as words or parts of words (other than with obvious reference to named male individuals), they have been used for literary purposes and are meant in their generic sense.

Where Does Authority Come From?

In the traditional sense, authority can be viewed as the right of an individual to accomplish a specific task. This right is granted by the management hierarchy to the individual based on past *performance*, as well as on his* perceived personal maturity and competence, and the likelihood that he will achieve the desired results. This right is essentially vested in the individual by granting him the *permission* to perform the task. Permission is generally accompanied by constraints, or limits, on the specific exercise of the task. For a program manager, the constraints equate to resource availability (money, time, organizations, and people) as well as cost, schedule, and technical performance requirements. The constraints on performance, along with the permission to perform, are embodied for DOD program managers in
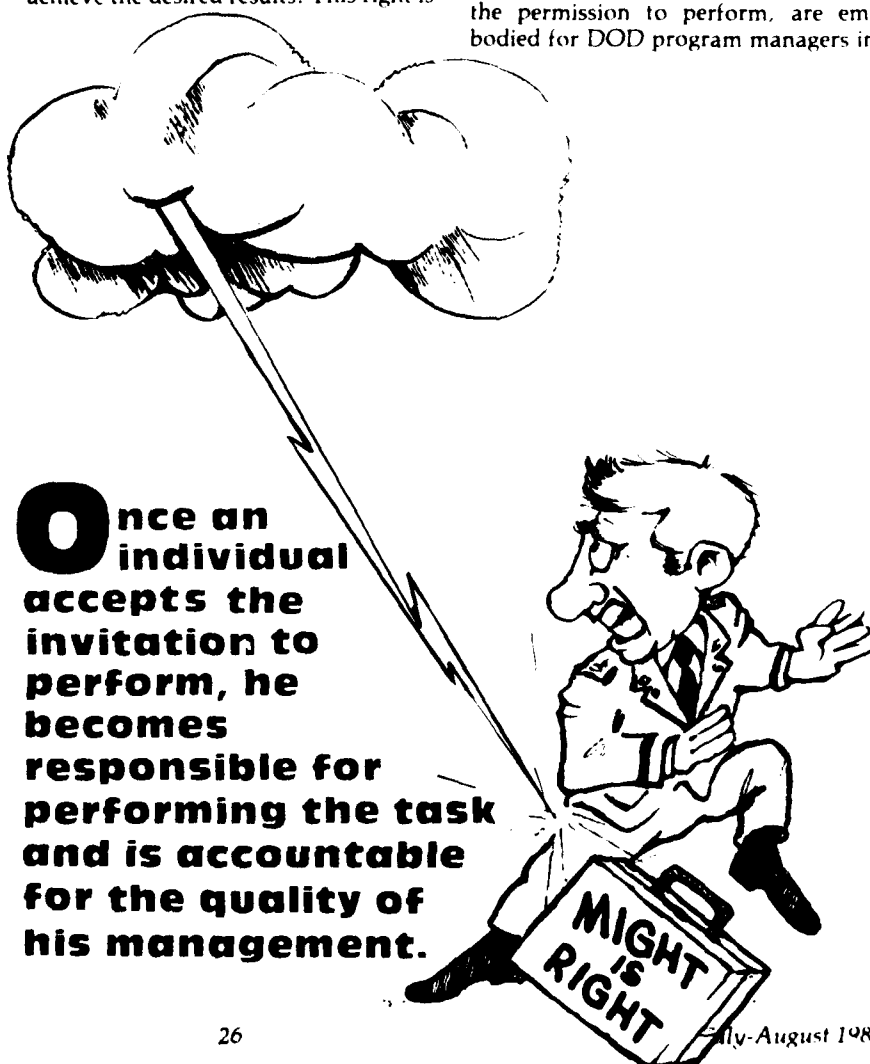
Once an individual accepts the invitation to perform, he becomes responsible for performing the task and is accountable for the quality of his management.

MIGHT IS RIGHT

a document called a program management charter. Once an individual accepts the invitation to perform, with its accompanying constraints, he becomes responsible for performing the task and is accountable for the quality of his performance.

What I have described constitutes the *initializing, legal,* or *formal* aspects of authority. It is a license to perform, which is prerequisite to performance. At best, it represents a minor part of a program manager's total authority scenario. The substantial part of the scenario depends directly on the individual's ability to perform the task and to achieve the specified results. The latter can be viewed as the *sustaining* aspects of authority; that is, the way the program manager goes about energizing and maintaining his exercise of authority or permission to perform. This is summarized in Figure 1.

As I see it, the problems managers have with authority are not so much a function of the *initializing* aspects of authority as they are of the *sustaining* aspects. It is true that there have been instances where a program manager has been denied the prerogative of performance because of arbitrary or inappropriate constraints. But, there have also been cases where a program manager has been able to overcome constraint problems placed on him through his ability to successfully practice the sustaining aspects of authority. This suggests that problems with authority may lie in the program manager's ability to exercise his permission to perform, which can be a phenomenon that is more personal than programmatic. Consequently, it might be beneficial to focus concerns about authority on the elements of its sustaining aspect.

The Bounds of Authority

The program manager's authority is dependent on the individual's interpretation of permission to perform, assessment of the probability of success, and leadership ability. These considerations are interwoven in an individual and manifest themselves in a program manager's aggregate managerial behavior. This is illustrated in Figure 2.

Major Dehner is an instructor in the Policy and Organization Management Department at DSMC.

Figure 1. Tenets of Project Authority

1. The initializing aspect of authority is the investiture of the individual with the PERMISSION to perform a specific task (a minor part of total authority scenario).

2. The sustaining aspect of authority is the ABILITY of the individual to perform the task (the substantial part of total authority scenario).

3. "Caveat" — the acceptance of permission to perform encumbers the individual with responsibility and accountability for performance.

THE CONSERVATIVE APPROACH

An individual's interpretation of permission to perform and his assessment of the probability of successful performance are interdependent. The manager who espouses a literal or restrictive interpretation of his charter believes the individual can do only what has been specifically authorized and nothing more. This may or may not be intended by the constraints. The literal approach could also be a direct indication of the manager's risk-aversion behavior. An excessively conservative management approach could result, exhibiting itself in the manager's seeking hierarchy approval for any action not specifically covered by his charter.

ENTREPRENEURIAL APPROACH

Conversely, the manager who believes he can do everything except what is specifically prohibited is taking

Figure 2. The Individual Dynamics of the Exercise of Authority

LEADERSHIP ABILITY

INTERPRETATION OF PERMISSION TO PERFORM

ASSESSMENT OF PROBABILITY OF SUCCESS
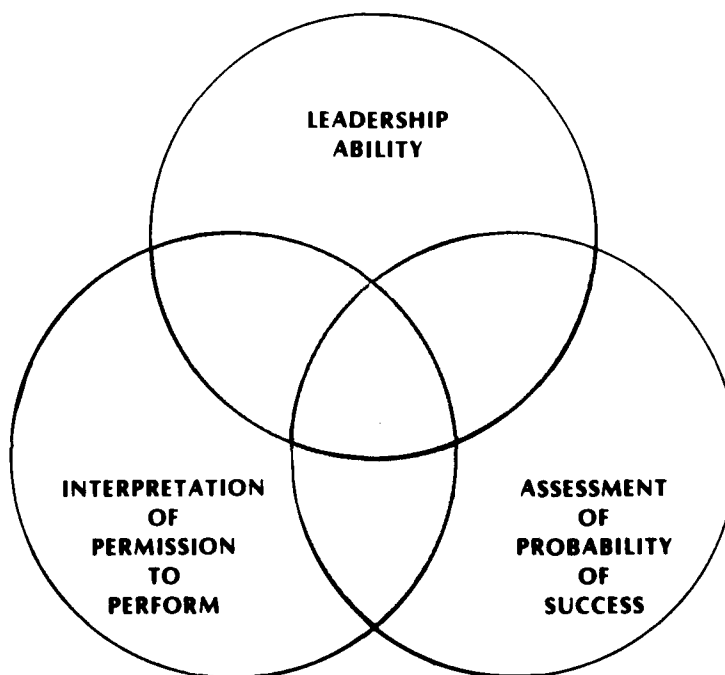
a broad interpretation of his charter. For the latter manager, risk-taking is natural and is accomplished under the auspices of performance flexibility. He is an energized, entrepreneurial manager for whom results are far more important than a continual solicitation of clarification of permission to perform. Such a managerial behavior pattern can come into conflict with the management hierarchy's interpretation of the manager's permission to perform. When this occurs, the entrepreneur's results orientation motivates him into the operational practice that "It is easier to obtain forgiveness than it is to get permission from the hierarchy." The entrepreneurial manager may even find occasions where he is able to negotiate, based on convincing justification, enlarged permission that covers actions previously prohibited.

Depending on organizational environment and the dynamics of the program being managed, the aforementioned conservative- and entrepreneurial-manager styles have specific situation-dependent advantages and disadvantages. However, the identification of these two styles puts bounds on the performance spectrum of a program manager, which is depicted in Figure 3. At any one time, the program manager's aggregate performance style tends to be a combination of both styles. It could be portrayed as falling in a band on the diagonal performance style line in the figure. This band would necessarily shift, based on program and environmental dynamics. Specifically, the width and location of the program manager's band on the performance spectrum is dependent on the following:

—The goals and structure of the organization and the functional areas involved in the program,
—The performance record, maturity and competency, leadership abilities, and needs and values of the manager himself, his management hierarchy, his peers, and his subordinates.

Leadership Style and Performance

I consider the program manager's leadership style to be the core element that enables task performance in the performance spectrum. It is the third factor in Figure 2 upon which his exercise of authority depends. Leadership can be viewed as the ability of a pro-

Figure 3. The Program Manager Spectrum
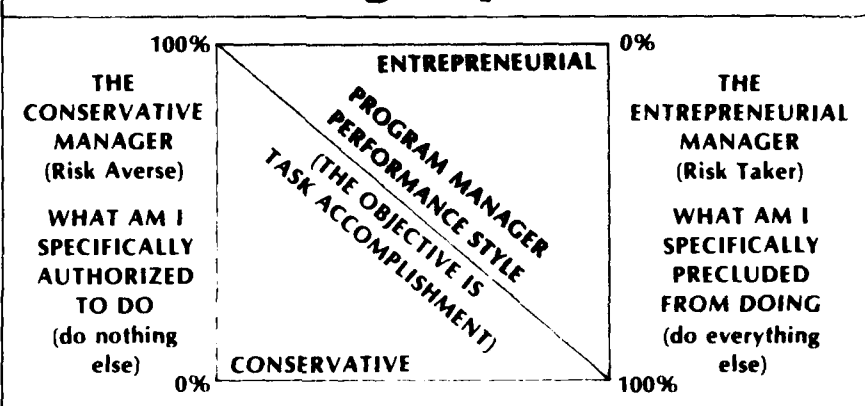
gram manager to *guide or influence* the actions of others (i.e., the hierarchy, peers, and subordinates) in such a way as to gain their willing cooperation in accomplishing a task. The manager can use many leadership styles in a situation-dependent manner; the style selected (i.e., directing, selling, management by participation, or delegating) is a function of the needs, values, maturity, and competency of his man-

The PM's permission to perform can be enlarged, reduced, or revoked because of his demonstrated management ability.
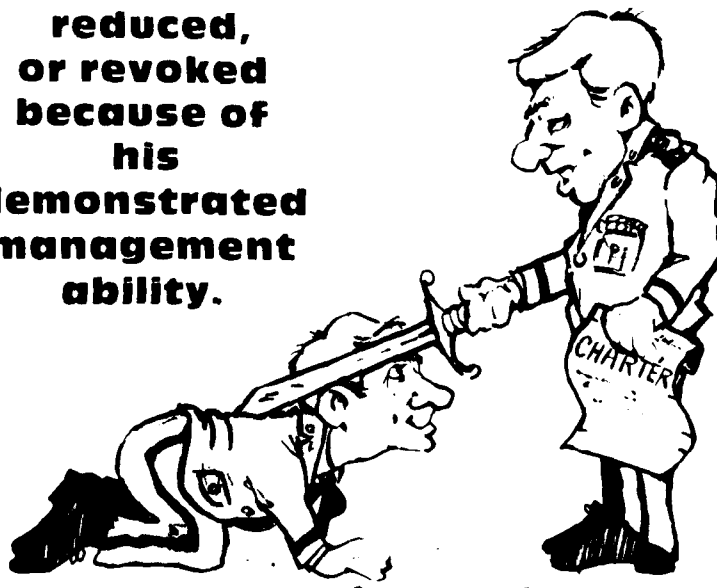
agement hierarchy, peers, and subordinates. It is the practice of leadership that instills trust, credibility, and commitment with all parties involved. It precipitates their coalition on productivity or results. Consequently, I classify leadership as the ultimate factor in project authority to ensure accomplishment of the task.

Conclusion

The total authority scenario of a program manager is a dynamic process. This is clear when the elements of the sustaining aspects of authority are reviewed; however, it is also true of the initializing aspects. The program manager's permission to perform can be enlarged, reduced, or revoked

Proposed New Military Standard and Data Item Description for Software Data Collection

The Electronic Systems Division (ESD) of Air Force Systems Command (AFSC) has been directing research aimed at creating a quality data base to support software cost estimation for defense system acquisitions. The products of this effort are a draft military standard for software work breakdown structures and a companion data item description (DID) for capturing technical characteristics of software projects. The documents together are known as the Software Acquisition Resource Expenditure (SARE) data collection methodology.

ESD/ACC is giving industry and DOD an opportunity to review and comment on the documents before be-ginning trial applications. If you or your organization would like to participate in the review, please fill out the response form below and mail it by August 15, 1983, to:

Electronic Systems Division
Directorate of Cost Analysis
Cost Management Systems Division
(ESD/ACCI)
Hanscom Air Force Base, MA 01731
Attention: Captain W. W. Jones

We welcome qualified responses from all sectors of industry, government, and academia. However, we ask that you request the documents only if you are willing to provide comments on a questionnaire that will be included in the review package. If you have any questions, please contact the Project Manager, Captain Wesley Jones, ESD/ACCI by telephone at (617) 861-5227 or AV 478-5227, or by mail at the above address.

Name _____

Organization _____

_____

Address _____

_____

_____

_____

_____

Telephone _____

1. How would you classify your organization?
   _____ Military
   _____ Other Government
   _____ Industry
   _____ Academia
   _____ Other: _____

2. Does your organization engage in software cost estimation?

   _____ Yes   _____ No

3. Does your organization collect data to support software cost estimation?

   _____ Yes   _____ No

4. Does your organization collect data on software projects for performance measurement and cost control?

   _____ Yes   _____ No

5. Are you familiar with MIL-STD-881A, "Work Breakdown Structures for Defense Materiel Items," and or DODI 7000.2, "Performance Measurement for Selected Acquisitions?"

   _____ MIL-STD-881A

   _____ DODI 7000.2

Program Manager Authority Scenario

(continued from page 28)

because of his demonstrated leadership ability, interpretation of permission to perform, approach to risk, and task performance. These factors are individual-dependent. In addition, the permission to perform can be changed because of changes in the task and/or the constraints that surround the permission. The latter are environmental changes that can precipitate, or are brought about by, changes in the program manager's exercise of authority. For the program manager, the initializing and sustaining aspects of his authority are interdependent. This interdependency needs to be carefully identified, energized, and monitored by each manager to assure their coalition in support of program results.

In summary, the program manager is well-advised to view his authority scenario as a multivariate and dynamic process. He needs to keep the sustaining aspects of authority properly energized and maintained in a manner best suited to the interests of his program. In the final analysis, it is up to the program manager—*and no one else*—to gain and exercise authority over his program.

Army Approves Re-employment Rights

The Department of the Army (DA) has recently approved a policy that gives DA civilians administrative re-employment rights within their agency when they accept an excepted-service teaching or research position at the Defense Systems Management College. Details of the policy will be published in a change to AR 690-300.

Coming in the September-October Program Manager

Special Supplement: DOD and Service Acquisition Organizations

Report on the DSARC Effectiveness Study

DSMC Automation

for the Future

John R. Snoderly
Associate Dean, Executive Programs and Information Resource Management Systems
School of Systems Acquisition Education

A few months ago, a major step was taken to bring DSMC closer to a fully automated management capability. In October 1982, I was chartered as the program manager responsible for acquiring a fully integrated Information Resource Management System (IRMS) for the College. Since then, work has been progressing (i.e., MENS, acquisition plans) to provide the College with a first-rate system in the '83-'84 time frame. The acquisition strategy of the DSMC IRMS is to first acquire the communication backbone of the system—a Local Area Network, or LAN. Competive procurement of the LAN is well under way, and the installation of the system should begin in early FY 1984.

The LAN will interconnect the six buildings that make up the DSMC campus and will provide a means to expand the existing closed-circuit television system as well as provide data information transmittal. Linked by the Local Area Network, the DSMC IRMS will permit allocation of information processing resources based on the needs of each DSMC administrative and operational organization. It is conceived as a fully networked set of workstations (executive and administrative), computers, and software. The IRMS will tie together the existing automated facilities of DSMC and make the resources of those facilities available to all professional staff, administrative personnel, and students.

The acquisition of an IRMS system will allow the College to provide the faculty and students with representative automated "tools" that can be applied to business, technical, and administrative problems. The IRMS will provide support to the unique requirements of each DSMC department and will produce concise, accurate,

and timely management and operational information. It will also allow expansion and enhancement of its capabilities and integration with other DSMC academic and simulation programs. The system will provide the following improvements to the current organization:

—Improved general academic administration of students;

—Improved student training facilities through simulation of real-world problems;

—The development and enhancement of program management support systems; and

—Improved support to program managers and program management offices.

The DSMC IRMS will result in automation of the following key functions of the College:

—Increased productivity of the professional staff by reducing paperwork

through the use of electronic mail, viewgraph generation, automated filing, etc:

—Increased productivity of the clerical staff through the use of word processing, automated administrative information, etc.:

DSMC personnel administration—This function consists of several specific personnel management tasks that will benefit significantly from automation. The first of these is the generation and monitoring of individual and professional development plans. Automation of this task will provide for a better match between the organization's goals and the goals of individual staff and faculty members. Regularity and consistency in the monitoring of individuals' progress toward meeting their plans will also result from automation. The other management tasks within this function that will benefit from automation in-

clude the maintenance of employee records and, as a by-product, the production of telephone books and personnel rosters and the management of parking spaces.

Office automation—An integrated approach toward automating DSMC office work tasks will provide the following capabilities: word management, electronic mail, electronic filing, and electronic calendars and their tickler files. By providing these capabilities, the specific tasks to utilize the automated techniques will grow rapidly as experience is gained. Tasks already envisioned for application include producing and maintaining the activity bulletin board, creating viewgraphs, generating lessons-learned reports, maintaining the System "X" (SX) documentation, and monitoring the status of research projects.

Accounting and financial management—The financial management system will take advantage of the capabilities of the office automation described above and will be integrated into the overall automated system of the College. In addition to assisting in the typical accounting and financial management roles of executing budget decisions made earlier by management, the automated system, with the appropriate software, can also assist the budget formulation efforts. This will be accomplished by creating an interactive environment whereby numerous alternative budget plans can be evaluated by the manager during the development of the budget.

Student support—The IRMS will include a number of capabilities that will improve the support provided to the students at DSMC. The most important of these involve the scheduling of courses and the analysis of entrance testing. Currently, academic scheduling is accompanied with computer assistance using proprietary software available only on a time-sharing contract. This severely limits the flexibility in the process. In addition, the current approach requires excessive inputs from the user. The IRMS will include the elements necessary to produce an effective scheduling system with minimal user inputs. All Program Management Course students are tested during the first week of the course to determine their incoming level of knowledge. This information is used to adjust the instructional plans. Automation of the process will provide the test results

earlier in the course than they are now available. This will result in an earlier alignment of the planned instruction with the students' needs. Analysis of the test results will assist the College in evaluating and changing the curriculum as required. Additional student support will include the analytical activities performed during case studies, the maintenance of student track records, the grading of SX cases, and the establishment of student sections.

Instructional support—The IRMS will also be capable of directly supporting the materials and instruction provided to the student at DSMC. One of the essential skills that the students must acquire in order to cope with the data-rich environment of the acquisition world is the ability to make maximum use of future, as well as current, state-of-the-art automated tools. As examples in this area, the following specific capabilities are planned for inclusion:

—Demonstration and practical experience in the use of automated PERT CPM and network planning in a project management environment;

—Statistical and mathematical routines to demonstrate available techniques to the student and to assist in research activities;

—Models to assist and demonstrate to the student the automated techniques available for analyzing contractor performance reports, such as those submitted under C/SCSC;

—Further, automation of the SX case studies, including a management information system to support decision-making, and additional automated decision exercises to improve the simulation of the program management office decision-making environment; and

—Exercising various models and "automated tools" available to assist the program manager in the execution of his total program responsibilities. Included in this area will be a statement of work agenda, cost-estimating models, reliability and availability models, and a demonstration of computer-aided design and manufacturing techniques.

Support of research—The research activities of DSMC will benefit significantly from the automation capabilities provided by the IRMS. The ability to create a timely library information retrieval system, a working reference file of research materials, a catalog of

project lessons learned, and an electronically accessible filing system for organizational management program data are just the initially conceived applications to the research efforts.

Physical plant management—The capabilities available within the IRMS will assist the management of DSMC facilities through automated record keeping and monitoring of the process involved in providing logistical support, production management, inventory control, and property management within DSMC.

The first IRMS implementation phase, which will be accomplished in FY 1984 and require the first block of workstations, will provide the following capabilities:

—Secretarial office automation to the department-head secretarial level;

—Electronic mail, calendaring, and other automation capabilities for professionals at the department-head level and above;

—Electronic mail capability from the DSMC management to the PMC section leaders;

—Automation of administrative and personnel functions, including financial management and accounting;

—Automation of student and classroom scheduling; and

—Research and information support automation.

The second implementation phase, which will be accomplished in FY 1985 and will involve the hardware in the second workstation block, will provide the following additional capabilities:

—Secretarial office automation to all other secretaries;

—Remaining student support functions automation;

—Automation of remaining instructional support functions; and

—Automation of physical plant management.

In the future, additional capabilities, such as teleconferencing, real-world program management problem-solving via the DSMC decision support system (DSS), and other improvements not as yet identified will become a part of the day-to-day operation at DSMC. It should now be evident that things will never be the same at DSMC, but such is the nature of program management—change!

Industry Program Field Trips Provide a Practical View

Field trips to contractor plants emphasize the vital role of industry in defense acquisition

Captain Frederick A. Farber, USN

Graduates of Program Management Course Class 83-1 got a practical view of real-life acquisition management and production issues before graduating in June.

With faculty advisors, the students spent 2½ days visiting selected corporations involved in production or construction of defense weapons systems. Table I shows the corporations and program managers that supported DSMC's Industry Program. Student critiques of the Industry Program lauded their experiences of being able to study real-life acquisition management challenges through direct interaction with both the DOD and corporate program managers *before* the plant visits.

The Industry Program is specifically designed to complement classroom learning with practical, real-life acquisition management and production issues. The learning objective for the students is to experience the industrial environment. The emphasis is on exposure to a side of the acquisition business that some government managers rarely see. The Industry Program concentrates on the practical experiences of the program managers (government and industry) and assigns one section of students (numbering about 30), to one of six major programs. Industry provided settings for students to directly approach and discuss development and production areas of special interest; likewise, students said they gained invaluable information on why and how a corporation manages a particular program.

Before the field trips, the students reviewed program documents provided by the DOD program managers. This documentation (including contract, DCP, TEMP, Logistics Support Plan, etc.), together with 1-day visits by the program managers to their assigned sections on the DSMC campus, provided a basis for issue generation by the students. This preparation was designed to serve as a road map for a meaningful agenda and discussions at the plant. Moreover, focusing on particular program "issues" raised the interest level among all participants.

Free and candid discussions among students and company personnel resulted in considerable learning, according to the students. This interchange of ideas, questions, and answers was intended to strengthen each student's view of the role that industry plays in the development and production of systems for the Army, Navy, and Air Force. Tours of manufacturing and assembly areas concentrated on processes, techniques, and quality assurance; the purpose was to relate why certain machinery or equipment is used, and to give the students an appreciation for the complexity and magnitude of effort in weapon system production.

The Industry Program complements classroom learning in the areas of business, technical, and manufacturing management. Equally important, students are expected to gain in experience through direct interaction with program managers.

Without the support of DOD program managers and their contractors, the learning by our future program managers would have been far less.

Table 1.

Industry Program Manager	Corporation	DOD Program Manager	Program
Mr. F. Delaney	General Dynamics, Camden, Ark.	COL R. Walker, USA	Viper
Mr. J. Songster	Rockwell, Deluth, Ga.	COL S. Cass, USA	Hellfire
Mr. W. Haggett	Bath Iron Works, Bath, Maine	CAPT D. Stembel, USN	FFG-7 Ship
Mr. W. Snodgrass	Gould, Cleveland, Ohio	CAPT G. Reynolds, USN	MK-48 Torpedo
Mr. H. Hamm	McDonnell Douglas, St. Louis, Mo.	Col C. Schaum, USAF	F-15 Fighter
Mr. W. Maguire	Hughes, Canoga Park, Calif.	Col H. Fisher, USAF	AMRAAM

Industry Students Get a Rare Look at Government Program Management

The industry students of PMC 83-1, the largest PMC industry group ever, hit the road in May to look behind the scenes on a number of government programs

"A rare, unique opportunity" is the way one of the 24 industry students from Program Management Course Class 83-1 described his opportunity to view hardware and program management from the government perspective during the recent field trip for industry students. The students, representing 22 major defense systems contractors whose firms manufacture products ranging from integrated circuits to missiles, aircraft, and aircraft carriers, spent a week visiting acquisition-related activities of the Army, Navy, and Air Force.

The group's travels took them to the Headquarters, Aeronautical Systems Division, at Wright-Patterson AFB, Ohio; the U.S. Army Armor Center, Ft. Knox, Ky.; and the Philadelphia Naval Shipyard. The students were able to review the management of major programs and hold discussions with program managers and program office staffs regarding current issues facing them.

The review included such diverse programs as the Air Force's B-1B bomber and C-5B airlifter; the Army's M1 Abrams tank and Bradley Fighting Vehicle; and the Navy's Aircraft Carrier Service Life Extention Program. The programs reviewed during the week represented more than a $50 billion investment in new and improved weaponry. Detailed discussions were conducted with government personnel ranging from soldiers assigned to an armored cavalry squadron to the hosting general officers.

Early during the Program Management Course the students planned the visits, placing particular emphasis on those areas in the acquisition cycle that were critical to them. The structure that evolved included emphasis on requirements definition and control, development planning, technology advancements, test and evaluation, and logistics support. In addition to identifying the topics of interest, detailed questions and issues were developed and provided to the host organizations to aid in their preparation for the students' visits. This planning process led to an agenda that covered program development from idea to hardware.

At the Aeronautical Systems Division the students reviewed the activities of the 4950th Test Wing and two major program offices. In addition, perspectives on program management from a panel of experienced practitioners were presented. The agenda also included a tour on board the Advanced Range Instrumentation Aircraft and a brief look at the history of aviation at the Air Force Museum.

The U.S. Army Armor Center at Ft. Knox afforded the students a look at the user's role in material acquisition and the operational testing of armor equipment for the U.S. Army. At the U.S. Army Armor School, the students were able to discuss the training of today's soldier, including the impact of complexity on training, training methods, and trends in simulators. During the day there were tours and demonstrations of the Bradley Fighting Vehicle and the Abrams tank.

The Philadelphia Naval Shipyard was the third stop, where the service life of the aircraft carrier USS Forrestal (CV-59) is being extended to 45 years under the Navy's Aircraft Carrier Service Life Extension Program (SLEP). Major life-enhancing modifications, fleet modernization alternatives, and repairs are in process for the Forrestal. Students were provided the opportunity to review the management techniques being employed in this 28-month program, as well as to tour the shipyard facilities.

The intent of the trip, which appears to have been realized, was to provide students from defense industry with a unique opportunity to view the government's way of doing business from concept through fielding.

Association of PMC Graduates Now Being Formed

A non-profit alumni association is being formed for graduates of the Defense Systems Management College's Program Management Course (PMC) and for past and present faculty and professional staff of the College. The purpose of the organization is to provide a forum for continuing professional growth in the defense acquisition community, through such media as a quarterly newsletter and an annual symposium (the first will be held this October). The Association will also provide a ready resource of professional acquisition managers for the College to draw upon. If you are a PMC graduate or a former DSMC faculty or professional staff member, and are interested in joining the Association or in assisting in its development, please fill out and return the form to:

Office of the Registrar (Alumni Section)
Defense Systems Management College
Fort Belvoir, Va. 22060

Name (last, first, MI)_____

Rank_____

Service, agency, or company_____

PMC Class_____

Present title or position_____

Address_____

_____

_____

_____

Telephone (home)_____ (office)_____

Committees you might be interested in working on:

☐Membership ☐Publications ☐Publicity/PR

☐Bylaws ☐Nominations and Elections

PMC Graduate Update

PMC 74-2

Lieutenant Colonel Clinton A. Hodder, USA, reports to the Naval War College, Newport, R.I., in August, after having commanded the 197th Support Battalion, 197th Infantry Brigade (Separate), Fort Benning, Ga., for 34 months.

PMC 81-1

Captain Thomas D. Ray, USAF, died in May following a scuba-diving accident near Anacapa Island, off the coast of Ventura County, Calif. At the time of his death, Captain Ray was assigned to the Satellite Data Systems Program at Space Division.

PMC 80-2

Lieutenant Colonel Douglas W. Morgan, USA (Ret.), has joined Litton Data Systems as a member of the Senior Technical Staff. He retired from the Army in April after serving as Executive Secretary to the Army Systems Acquisition Review Council for 2 years.

PMC graduates: Send your input for PMC Graduate Update to Inside DSMC, Publications Directorate, Defense Systems Management College, Fort Belvoir, Va., 22060. Be sure to include your PMC class number.

FEEDBACK

Dear Sir:

I have read many issues of your journal *Program Manager* and other alleged good-management-type propaganda. Each time I read these "good management" articles the following questions come to mind:

—A lot of good ideas but good for what?

—What does it all mean?

—Where will it all end?

—Will the "do-gooders" get better while the real world gets worse?

—Good management goes on forever (it's parasitic) as long as it is responsible for very little. Does this sound like, "Those that can't do, teach; those that can't teach, teach teachers"?

It appears that good-management do-gooders are staff people who have no direct line responsibilities. Maybe your journal should highlight some program's horror stories that expound on real problems—such as being between a rock and a hard place with no good solution and having to select the best from a bad lot.

Do you think we may have reached the point of no return when it comes to preaching good management? It is a shame that we cannot use only those management techniques needed for a particular situation.

A voice from the wilderness,
Richard E. Meoli
AFPRO/EN Rockwell Int. Corp.
North American Aircraft Operations
Los Angeles, Calif.

Freedman · Gambrell · Ostlund · Stavenjord · Swart

Staff Additions:

Donald M. Freedman has rejoined the DSMC staff as Head of the Policy and Organization Management Department. Mr. Freedman holds an A.B. degree in economics and a B.S. degree in engineering, both from Tufts University; an M.P.A. degree in computer science from the American University; and an M.S. degree in systems analysis from the University of Rochester.

Major Melvin B. Gambrell, USAF, is an Instructor in the Policy and Organization Management Department. He is a graduate of PMC 83-1, and holds a B.A. degree in psychology from Oklahoma State University, and an M.S. degree in psychology from Harding University. Before coming to DSMC as a student, Major Gambrell was stationed at Randolph Field, Texas.

Lieutenant Colonel Ted Ostlund, USA, a graduate of PMC 83-1, has joined the staff as an Instructor of Systems Engineering Management, Technical Management Department. His last assignment was at the U.S. Army Computer Systems Command, Fort Belvoir, Va., where he was in the Program Management Office, Tactical Management Information Systems (TACMIS). Lieutenant Colonel Ostlund holds a B.S. degree in business administration from California State Polytechnic University.

Kenneth H. Stavenjord is a Professor of Engineering Management in the Acquisition Management Laboratory. He came to DSMC from the Naval Sea Systems Command, where his last position was Foreign Military Sales Director, Surface Warfare Systems Group. Mr. Stavenjord holds three engineering degress: a B.S.M.E. and a B.S.E.S., both from Gonzaga University, Spokane, Wash., and an M.S.M.E. from the University of California, Santa Barbara.

Robert L. Swart, Jr., holds the Department of Navy Chair in systems acquisition management, Executive Institute, Office of the Commandant. Before coming to DSMC, he was the Director of Plans, Programs, and Financial Management, Trident Systems Project Office, PM-2, Naval Material Systems Command. Mr. Swart holds a B.S. degree in electrical engineering from the U.S. Naval Academy. He is a Commander in the USNR (retired).

Staff Losses:

William R. Barwick, Head of the Policy and Organization Management Department, retired.

Major W. A. Byrne, USAF, Executive Officer, Office of the Commandant, to the Air Command and Staff College, Maxwell Air Force Base, Ala., where he will be a student for 10 months.

Major Frederick T. Dehner, USAF, Instructor of Acquisition Management, Policy and Organization Management Department, is retiring after 20 years of service. He will be a program manager at Sanders Associates, Inc., Nashua, N.H.

John D. Elliott, Professor, Policy and Organization Management Department, to DCSOPS, HQDA, to be Deputy Director of the Long-range Planning Group.

Lieutenant Colonel George J. Ellis, USAF, Instructor and DSMC Organization Development Consultant, Policy and Organization Management Department, has retired after 26 years of duty. He will be a professor for the University of Southern California, Eastern Region; professor for Golden Gate University, Eastern Region; and a professor at Marymount College, Arlington, Va.

Petty Officer First Class Frank Flack, USN, Academic Support Directorate, to Mayport, Fla., for sea duty aboard the *USS Luce.*

Commander Edward Tabb Justis, USN, Instructor, Systems X, Acquisition Management Laboratory, retired.

Lieutenant Colonel Barry W. Levine, USA, Technical Management Department, to Fort Leonard Wood, Mo., to be Commander of the 4th Battalion, 2d Training Brigade (OSUT).

Colonel Dirk H. Lueders, USA, Deputy Commandant, has been assigned as Joint Test Director, Targeting Procedures for Laser Designators, Deputy Director Test and Evaluation (DDT&E), Office of the Secretary of Defense. He is located at the Operational Test and Evaluation Agency (OTEA), Falls Church, Va.

George R. McAleer, Jr., Head of the Acquisition Management Laboratory, School of Systems Acquisition Education, to the Industrial College of the Armed Forces (ICAF), Fort McNair, as a professor of acquisition management.

Lieutenant Colonel G. E. Morrow, USA, Special Assistant for the Contractual Program, Department of Research and Information, to the Operational Test and Evaluation Agency (OTEA), Falls Church, Va.

Colonel Kenneth E. Nidiffer, USAF, Technical Management Department, to Headquarters, Air Force Systems Command, Andrews Air Force Base, Md., where he will be the Director of Computer Resources.

Lieutenant Colonel Daniel G. Robinson, USAF, Policy and Organization Management Department, to Wright-Patterson Air Force Base, Ohio, to be Deputy Director of the Air Force Business Research Management Center.

Lieutenant Colonel Charles H. Ulrich, USA, Technical Management Department, to Headquarters, U.S. Army Missile Command 'Redstone Arsenal, Huntsville, Ala.

Graduates of DSMC courses are expected to use their education and training to improve the management of defense acquisition programs. This is particularly true for graduates of the Program Management Course (PMC), who have been prepared for the key job in the acquisition business—that of program or project manager. The letter reproduced below was sent to each of the graduates of PMC 83-1 by the Administrator, Office of Federal Procurement Policy. It reflects both the caliber of the people who attend the PMC, and the regard in which they are held throughout the acquisition community.

EXECUTIVE OFFICE OF THE PRESIDENT
OFFICE OF MANAGEMENT AND BUDGET
WASHINGTON, D.C. 20503

OFFICE OF FEDERAL
PROCUREMENT POLICY

JUN 3 0 1983

Major ....

Dear Major ....

I was very pleased earlier this summer to be present at the graduation exercises held at the Defense Systems Management College at which you and your fellow class members were recognized upon successful completion of the Program Management Course (Class 83-1). The course has the reputation of being rigorous and demanding, and I congratulate you on this signal achievement.

The role of program manager — both within and outside of Government -- is both a very satisfying and challenging one. As you well know, it demands persons of the highest intellectual caliber and with pronounced leadership abilities. It also demands persons versed in a broad series of technical, administrative and management disciplines, not the least of which is procurement.

Because of the importance of the procurement process in your future program management assignments and because of the rapidly changing profile of procurement, I think you may be interested in the enclosed materials. They describe some of the major procurement reforms directed by President Reagan, as reflected in the Administration's proposal for a Uniform Federal Procurement System, which was submitted to the Congress last year, and Executive Order 12352. Also enclosed is a copy of the recent OFPP report to the Congress on activities and accomplishments during the past two years.

I hope you find these publications of interest. If you have any comments on either OFPP's agenda or the specific procurement reforms we are pursuing, I would appreciate hearing from you.

Again, congratulations and best wishes in your career.

Sincerely,

Donald E. Sowle
Administrator

Enclosures

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